

**Insight into**

# **Scientific Research**

**In Indian Universities &  
The Institutes of Technology**

**Rais Ahmed**

**Madhulika Rakesh**



**Council of Scientific & Industrial Research  
New Delhi**





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**COUNCIL OF SCIENTIFIC & INDUSTRIAL RESEARCH**  
Rafi Marg, New Delhi-110 001





ISBN 81-85038-96-1

*The work is based on a CSIR project "Investigation on Efficiency, Character and Quality of Scientific Research in Indian Universities and the IITs"*  
*All Opinions Expressed are those of the Authors*

### PROJECT ADVISORY COMMITTEE

Prof. G. Ram Reddy, Vice-Chancellor, Chairman and later Prof. V.C. Kulandaiswamy; Prof. P.N. Srivastava, then Member, Planning Commission; Dr. D.N. Misra, then Adviser, CSIR; Dr. Ashok Jain, Director, NISTADS; Prof. L.S. Kothari, Delhi University; Dr. S.P. Gupta, Additional Secretary, UGC; Prof. G.D. Sharma, NIEPA; Prof. Shakti R. Ahmed, then Director, School of Sciences, IGNOU, Co-principal Investigator

### RESEARCH TEAM

Mrs Madhulika Rakesh, Research Associate;  
Mrs Shreyosi Kanta and Miss Nupur Awasthi, SRFs

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*Designed and Printed by*

Publications & Information Directorate, Dr K.S. Krishnan Marg, New Delhi-110 012



## PRETEXT

My team of researchers has spent three years in planning the research reported here, nagging the professors in 27 institutions to answer the questionnaire, visiting universities all over the country to coax and persuade scholars to respond to another questionnaire, feeding the computers, analysing the data and making hundreds of tables and graphs. What is presented is but a fraction of the information gathered and processed. A huge number of manhours has gone into this effort in which thousands of otherwise busy people participated. At this point, when all is done, as the Principal Investigator, I reflect and ask myself the question why did I do it? What was my drive, what sort of questions and uncertainties were in my mind which created the urge to find answers. Perhaps, many readers would find an echo of their own thoughts in mine if I explain a little further.

Like all humans I am attracted to beauty and I am mystified about what it is. You may reflect for a moment on your own experience with beauty. You would agree that no objective criterion of a beautiful painting or a person exists. All that one can say is that beauty is an ensemble of many harmonious, or even contrastive, components and its appreciation is personal or subjective. This is so notwithstanding the fact that some objects of beauty may have a wider appeal than others.

As an academic scientist I have been equally intrigued by the question of quality, whether it is the quality of an answer to a question asked in the examination or that of a student as a whole, or more particularly, the quality of a piece of creative work or the quality of a scientist. In this case, clearer evidence is available to the effect that evaluations are subject to wide fluctuations depending on many factors and that there is a strong subjective element. Research on examinations and interviews has established this and experience with evaluation of research papers by referees confirms the same. Again, irrespective of the fact that there may be some convergence of opinion at both ends of the quality spectrum.

There is undoubtedly – and perhaps philosophically, a parallel between beauty and quality, but it has been a matter of concern for me that while no body thinks of measuring beauty in terms of components and by means of marks, grades or other indices, we have become unduly committed to measuring quality in this manner. In the name of objectivity, we tend to accept a set of numbers as a safe, simple and even satisfactory description of quality. Naturally, every claimant of quality then tries to improve the score – of marks, grades, or of the number of publications or the citation index. In my opinion this has happened much to the detriment of both education and research. A more comprehensive evaluation is needed, and particularly where the performance of institutions or a system is to be assessed.

In formulating and designing the present study my motivation was to



explore the wider field of evaluation in research by examining several aspects of the process by which research is done, and by delving into organizational patterns, human relations, values and attitudes which play a significant role in creating the circumstances in which creative work is done, the "soil" in which research germinates and grows.

A part of my motivation for this project arose from my experience of participating in numerous governmental or officially sponsored committees and those gatherings of scientists where a freer exchange of views took place. The contrast between the relative smugness or even exuberance of views expressed at one level and more critical evaluation of the performance of the system at the other level must have been noted by many people, particularly because good many of the participants of these discussions at the two levels are common. Perhaps, the terms of reference which are implicit in one set of gatherings are different from those in the other. But then, what is the truth? It is of even national importance to know the answer. This reinforced my urge to evaluate the system at the large – howsoever imperfectly in the first venture. Since I was a part of the university system and hence more familiar with it, I chose to examine the realities connected with scientific research in this system. The effort was to avoid preconceived notions and improper generalisations, or an impressionistic view, so that in a sense, the scientific method could be applied to the overall assessment of the performance of our institutions.

These vague and somewhat mysterious questions were quite a challenge to address. It is truly an open-ended enquiry into the quality, character and efficiency of scientific research in the designated category of institutions.

The outcomes are not explicit and indeed they cannot be as I have argued. But the many parameters of evaluation which have been explored have to be holistically interpreted by sensitive policy makers and organizers of research. I am an unrepentant supporter of research in the universities and a believer in the special potential of this sector what with all its ever-refreshing intellectual springs and all its freedoms, and to me many of the outcomes have been unexpected and some have been disconcerting. The sociological composition of the research workers was unexpected but it strengthened my conviction about changes in the educational programmes to make up for the natural deficiencies of this group. The unexpected strength discovered in the most neglected sector of the institutions, namely the state universities, would be welcomed by all. It only shows that creativity is widespread whereas we have become accustomed to concentrating our resources in a small set of selected institutions. In connection with the unhappy findings related to the crucial question of evaluating quality and recognizing merit at every stage of the educational and research process, not only did I cause a double check to be made of some of the data, but also, for a moment at least, I wondered whether publishing it would hurt or help the system. But I thought the result



of a scientific inquiry cannot be brushed aside simply because it reveals certain grave inadequacies. One likes to believe that the uncovering of the weaknesses will cause a debate and, finally, measures will be adopted to overcome these difficulties some of which are deeply rooted in the "culture" that we have or the historic moment which our society is passing through. This may have significance for many developing countries who place their trust in the scientific work of their institutions.

It must be said that not being a professional specialist in this area of research, I am not aware of studies of such scope having been conducted in other countries. There are, therefore, no bench marks, no similar data from another set of institutions, or other fields of research, or other countries – but smugness, complacency or even success in some aspects of research can hide many unsavoury facets in other sectors and it can prevent us from realising the potential that we have. From scientifically advanced countries too one hears occasionally of plagiarism and fraud, of prejudice based on colour, sex and ethnicity – or of supervisors taking advantage of their position vis-a-vis the scholars. But how occasional is occasional? Unfortunately, we now happen to have some figures – but there is nothing to compare them with. If we estimate roughly 30% of our research to be good, we still do not know if a much higher percentage of research is good in some other country. But my point is that without being dismayed by the findings, we have to direct our efforts at measures to radically improve the situation in the years to come. Some of the foci of weakness have been identified and we can concentrate our efforts on dealing with specific inadequacies. If this research helps us in doing so, our labour would have been rewarded.

RAIS AHMED





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**ABBREVIATIONS USED IN THE TEXT**

|        |   |                                                                               |
|--------|---|-------------------------------------------------------------------------------|
| CU     | : | Central Universities                                                          |
| SU     | : | State Universities                                                            |
| IIT    | : | Indian Institute of Technology                                                |
| IISc   | : | Indian Institute of Science                                                   |
| UGC    | : | University Grants Commission                                                  |
| CSIR   | : | Council of Scientific and Industrial Research                                 |
| DST    | : | Department of Science & Technology                                            |
| NIEPA  | : | National Institute of Educational Planning and Administration                 |
| COSIST | : | Committee for Strengthening of Infrastructure of Science and Technology (UGC) |
| DSA    | : | Department of Special Assistance (UGC)                                        |
| CAS    | : | Centre of Advanced Study (UGC)                                                |
| DRS    | : | Department of Research Support (UGC)                                          |
| SAP    | : | Special Assistance Programme (UGC)                                            |
| SRF    | : | Senior Research Fellow                                                        |
| JRF    | : | Junior Research Fellow                                                        |





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## CHAPTER I

# Introduction

### Science, Technology and Economic Development

**1.01** There is no question but that science and technology are the heart and soul of modern industry and agriculture, transport and communication. They are essential for the utilization of all natural resources, for the maintenance of human health and welfare, and for the dissemination and advancement of culture. Leadership in science and technology depends on research and development, and hence R&D is the cornerstone of leadership in industry, trade, defence and numerous other walks of life. In this sense, scientific and technological research is the basis of immense power of some countries of the world, and of their domination over economic and political decisions, including security and sovereignty, of the rest of the world. For this reason, the advanced industrialised countries spend large proportions of their immense income\* on scientific and technological research. Thus, in addition to their own intellectual capacity they are able to attract highly trained persons from other parts of the world because of better emoluments and opportunities of challenging work that they can offer. In this way their leadership is not only maintained but also strengthened with the passage of time. The rest of the countries, because of a variety of competing social demands which require immediate expenditure, are able to spare a much smaller fraction of their small income on scientific and technological research. Therefore, their competitiveness and productivity suffer; their ability to hold on to the best of their brains suffers, and even the perception of their societies and its leadership towards benefits of research runs down. The result is that the scientific and technological gap increases. Leadership of the advanced countries in the sphere of knowledge in science and technology becomes so dominant that their ideas and concerns influence scientific work in all the other countries and make even their creative contribution an appendage to the science of the developed countries.

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\*Typically 2 to 3.5% of GNP in the industrialised countries (with some spending as much as 6% of GNP) and less than 1% in most of the developing countries.



**1.02** There are undoubtedly other factors, for example, there is the need of capital to harness scientific and technological knowledge and for historic reasons this has been available only to a few countries which had colonised the rest of the world and thus drawn upon its wealth. Again, science and technology have contributed not only to growth and welfare in the world, they have also been an instrument of war and destruction, and through over-exploitation of the resources of the earth and, pollution of its environment, they have been a source of great ecological problems. The root of the motivation for the use of science and technology one way or another lies in socio-economic structures of societies and nations. In the case of the developing countries, unwise social and economic policies, often distorted by vested interests, have caused their failure to realise the potentials of science and technology in transforming the quality of life of the people. For example, in India education and research have been recognized to be crucial for national reconstruction and advancement, but in practice, budgetary allocations have not reflected this recognition for the last so many decades. Industrial and commercial policies have often been pursued in such a manner as to undercut indigenous technology and science.

**1.03** Nothing, however, should distract us from the central fact that economic growth, national security and welfare of the people are intimately and crucially dependant on scientific and technological research. Technological research and development cull out relevant knowledge existing anywhere in the world, and if necessary, they have to generate new ideas and processes for the solution of specific problems of our socio-economic development. If we do not have the human resource to do this, solutions found to fit in other situations and, either mentioned in books or in promotional literature of various firms, are likely to be extended to our specific problems, with the result often of compounding these problems. Even to import technology, which is hardly available in up-to-date status, highly competent and discriminating national expertise is necessary.

### **Crucial Role of Scientific Research**

**1.04** Scientific research, on the other hand, is at the back of all technological research. It is truly said that science of today is the technology of tomorrow. It is almost impossible to visualise a country with top class technologists, where scientific research is weak or backward. There is so much of symbiotic relationship between scientific and technological research that very often the generic word scientific research includes technological research. Thus scientific research has a place of prime importance in national life for advancing all national aspirations. At the same time its importance is not only utilitarian but also for providing intellectual excitement and adventure, enhancing the

mental capacities of a nation. Any nation that ignores this basic stimulus of national progress or considers it an “elite” or “high brow” activity and counterposes it with such objectives as “rural development” or “poverty alleviation”, or even “moral and spiritual values” would indeed be short sighted in respect of its future, and would not achieve its objectives. Rural development, for instance, is not only building of houses and roads – it also means sanitation and health; apart from land reform, it means industry in its most advanced form to sustain agriculture with fertilizers, pesticides, power generation for irrigation and cold storage, and it extends to biotechnology and much else.

**1.05** In the case of India, with whose scientific research this book is concerned, the vision of scientific and technological development as an integral component of economic freedom and future growth was clear enough in the minds of those who were leading the struggle of the country for emancipation from British rule. Scientific research had already received much encouragement from the government in the founding of chains of laboratories concerning scientific activity in fields related to industry, agriculture and atomic energy, and enhanced funding in the universities, when in 1958, the Scientific Policy Resolution was adopted by Parliament. This oft quoted Resolution said in part : “The dominating feature of the contemporary world is the intense cultivation of science on a large scale, and its application to meet a country’s requirements. It is this, which, for the first time in man’s history has given to the common man in countries advanced in science, a standard of living and social and cultural amenities, which were once confined to a very small privileged minority of the population. Science has led to the growth and diffusion of culture to an extent never possible before. It has not only radically altered man’s material environment, but, what is of still deeper significance, it has provided new tools of thought and has extended man’s mental horizon. It has thus influenced even the basic values of life, and given to civilization a new vitality and a new dynamism.” This perception, followed by government support to scientific research, led to rapid expansion of a system of research laboratories which, in 1986\* stood at 320 “Science and Technology” institutions, of which 240 were major S & T institutions. There were over 900 in-house R & D laboratories in public and private sector industry. The total expenditure on R & D in the Centre rose from Rs. 46.8 million in 1950-51 to Rs. 24,812 million in 1987-88#. This expenditure has to be seen in the context of fall in the value of the Rupee, as well as the expansion in the number of scientists employed. When both these adjust-

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\*Programme of Action approved by Parliament in 1986.

# Research & Development Statistics, 1986-87, Department of Science & Technology, Government of India (Table 1, p.43).



ments are made, although exact figures are not available, the expenditure per scientist is most likely to have actually declined. Most of the research laboratories of the agencies were set up in this period and employment under the central agencies must have increased by a factor of more than 50, while value of the Rupee has fallen by a factor of more than 10.

**1.06** There are numerous difficulties in the way of the proper development of scientific and technological research in India - which may be typical of what has happened in most of the developing countries which had started out well, and with great expectations, in the middle of this century. Not the least of these difficulties is related to socio-economic and political policies of the governments. They faced the need of competitiveness and modernity in industry when great proprietary impediments existed in obtaining technology from abroad. Even access to knowledge and equipment in crucial fields was seriously curtailed. In this situation, instead of mobilizing their great potential in scientific and technological manpower, and linking its activities with the productive system, governments took the seemingly easier, but the short-sighted course of allowing industry to import production machinery and obtain licences for the use of processes developed abroad; even processed raw materials were allowed to be imported. Strangely, they allowed purchase of know-how sometimes when comparable processes or materials had been developed by their own scientists. No doubt, this course of action had the active support of the developed countries; it suited them because it ensured profit as well as dependency of the developing countries. The very knowledgeable scientist, Prof. Abdus Salam writing in *Future* (24-25, Spring-Summer 1988) asked rhetorically "But what is wrong with science and science-based technology in the Third World today?" and he answered : "Three things : (a) A lack of meaningful commitment towards science, either pure or applied; (b) The manner in which we run our scientific enterprise; and (c) A lack of commitment towards acquiring self-reliance in technology in most Third World countries."

### **Scientific Research and the Universities**

**1.07** Scientific research may be conducted in many types of institutions, such as the research establishments of the governments, the universities, the research laboratories of industry and private establishments. There is difference in the nature of research conducted, inherent advantages, costs involved, and possible linkages with the productive system among these institutions. Situations may also be different from country to country in respect of the role and evolution of the system. Therefore, it is not possible to take an ad-hoc view of the support, a particular set of laboratories must receive in order to play an optimum part in research and development in any country.



**1.08** However, the unique advantages of the university system are universally accepted. Every sector of scientific research in a country has to draw upon higher education, training and research provided by the universities, and therefore the size of the one has to depend on the size of the other. Within the universities, the quality of higher education depends upon the existence of high quality creative activity in the form of research. Fresh minds, without set approaches, constantly enter upon research and have the potential of working on many new ideas. Since a great deal of research requires interdisciplinary support, the universities, by their very nature, are able to provide it, thus augmenting their capacity to undertake worthwhile research, and to do so economically. No small role is played by freedom and lack of hierarchy in the university system, because it allows that research to be undertaken in which the scholar is deeply interested; while relative freedom of discussion and criticism ensures a pooling of the intellectual resources of the community of scholars. It is believed, since the scholars know that they have limited time to spend in the institution, they spend it with greater dedication and effect. These conditions are most appropriate for basic research, and it is for this reason that the universities are accepted to be the main centres of basic research. They do, however, undertake, for a variety of reasons, applied research and, to a lesser extent, get involved even in industrial research. These factors have led to the position that university research is much valued and, with recent advances in sophisticated technology, is much sought after.

**1.09** It is because of the above mentioned reasons that as much as 30% of the total national R & D expenditure\* in some developed countries is devoted to university research. In India, this figure was, at the most, 6% in 1986! The low percentage share of the universities is partly related to the policy decision taken by the Indian Government soon after Independence in 1947, that university research then being very weak, country's main research effort would have to be based in the new chain of research laboratories. In fact, the salary scales of scientists in these laboratories were higher than those provided in the universities and, therefore, many good scientists migrated from the universities to these laboratories. It was realised only in the mid 60's that this policy was counterproductive because it tended to dry up the very source of high class manpower from which the laboratories drew their sustenance.

**1.10** In 1966, the Education Commission, in its extensive Report, devoted a whole chapter to science education and research and said in Para 16.46:

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\*Programme of Action, passed by Indian Parliament in 1986, Chapter on Research and Development.

“A major weakness of Indian education and research is the relatively small part played by the universities in the sum total of Indian research which itself is far smaller than what it should be in relation to our capabilities and needs. A stage has been reached when deliberate support and encouragement of advanced study and research in the universities should become a fundamental goal of our national policy. This is central to the entire progress and development of science in the country.” As a result of the Report of the Commission, the Parliament adopted a Resolution in 1968, which, in part said : (para 12e) “There is a need to give increased support to research in universities generally. The institutions for research should, as far as possible, function within the fold of universities or in intimate association with them.” Notwithstanding the Resolution, in the last two decades, no such laboratories have been established, mainly because the forums in which decisions are taken are overly represented by the system which already exists.

**1.11** A similar statement regarding research laboratories of national importance is included in the National Policy on Education and the Programme of Action, both approved by Parliament in 1986. However, with the apex bodies constituted as they are, there is little hope of any change in the situation. The universities are apprehensive of continued lack of financial and systemic support.

**1.12** It is worth noting that even on scanty resources, and with majority of institutions suffering from many deficiencies, the expansion of higher education has led to scientific research in the university system multiplying many times over what it was a few decades ago. Table 1.01 gives some data, from which it can be seen that in 1952, one in 20 M.Sc.'s obtained the Ph.D. degree, whereas in 1984 one in seven M.Sc.'s went on and got the Ph.D. degree.\* This is partly because of the limited employment market for M.Sc.'s and partly because many more research fellowships became available. Around 1965, the Council of Scientific and Industrial Research decided to help in the expansion of research in the universities by awarding every first class M.Sc. a scholarship if he or she joined research. The number of Ph.D's produced soon doubled. But as M.Sc. enrolment and the number of first class degree holders kept on increasing, a selective process was introduced in mid 70's. In 1973, the University Grants Commission made a Ph.D. degree essential for appointment of Lecturers, and this caused a second spurt in the award of Ph.D. degrees a few years later. The stipend of the Junior Research Fellowship was considerably raised in the early 80's and the

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\*Research & Development Statistics (1986-87), Department of Science & Technology, Government of India, New Delhi (p. 57).



**Table 1.01 : Out Turn from the Universities**

| Year  | 52   | 56   | 60   | 64   | 68    | 72    | 75    | 79    | 84    |
|-------|------|------|------|------|-------|-------|-------|-------|-------|
| M.Sc. | 2129 | 3255 | 5382 | 8882 | 12682 | 15951 | 17341 | 17439 | 20341 |
| Ph.D. | 108  | 210  | 361  | 537  | 1100  | 1311  | 1484  | 2261  | 2954  |

University Grants Commission also increased the number of Fellowships available. Thus, today the research enrolment in the sciences is of the order of 20,000 and the number of Ph.D. degrees awarded every year is about 3000.

**1.13** The university system has a large base of scientific research as indicated from the figures above. It is also large as compared to the national R & D system. An estimate of the total number of scientists working in the two systems and the total number of Ph.D.s involved is given in Table 1.02. This Table indicates that approximately 74% of all postgraduate and research degree holding scientists are in the university system, and a similar percentage of all employed Ph.D.s is in the university system. The share of financial allocation for scientific research in the universities, which is just a few percent of what the nation spends on scientific research, as a whole, is therefore highly unbalanced, and it is a handicap to the scientists working in the universities. Some informal studies have been made regarding scientific papers published in standard journals and they indicate that the universities are making a larger contribution than the research laboratories. Of course, the output of the laboratories cannot be measured only by the papers published by scientists there, but, the disproportion is so large that it is worth taking note of.

**Table 1.02 : Share of P.G.s/Ph.D.s in R & D and University Sectors  
(Indian Context)**

| Category         | Total  | * R&D Sector | #University  |
|------------------|--------|--------------|--------------|
| Ph.D.s (Science) | 13,194 | 4,194 (32%)  | 9,000 (68%)  |
| P.G.s (Science)  | 26,164 | 6,164 (24%)  | 20,000 (76%) |
| Total            | 39,358 | 10,358 (26%) | 29,000 (74%) |

**1.14** The circumstance that, on one hand, government has clearly recognised the role of science and technology in economic development, but on the other, it has been unwilling to allocate necessary funds for this activity, which has to function at international standards and, at ever increasing costs due to

\* Research & Development Statistics (1986-87), Department of Science & Technology, Government of India, New Delhi (p. 60-61).

# Estimated on the basis of Data available in UGC Report.



sophistication, has led the scientific community in the country to strain practically all its effort towards augmentation of resources for scientific research. The university scientists have been at a greater disadvantage and hence they too have been pressing, for several decades, to improve the availability of funds both to strengthen the infrastructure and to undertake competitive research. In recent years another demand of the scientists has been to bring about some degree of coherence in research activity with the planning of economic development. In both these aspects only limited success has been achieved and much remains to be done.

**1.15** The question of funds apart, in the intimate and frank discussions among scientists, there has been a constant and increasing concern about both the quality of scientific research produced and the constraining processes by which it has been produced. There are numerous articles which have been written about excellence in science, the importance of Basic Research and the need to establish major facilities in order to do research at the frontiers of knowledge. The Indian Science Congress Association devoted a whole session of the Congress in 1984 to the subject : Excellence in Science. The presidential address at the Indian Science Congress Session in 1984 was delivered by Prof. R. P. Bambah presently Vice-Chancellor of Panjab University, Chandigarh, on the subject, "Quality Science in India: Ends and Means." Prof. Bambah identified certain steps which could improve the situation and dealt with the question of gifted students being selected for educational programmes of a high quality, providing suitable career prospects in order to attract talent and motivate research scholars, developing suitable administrative mechanism for giving recognition to all members of a team, improving the examination and thesis evaluation system, and freeing the universities from "mediocrity, parochialism, inbreeding, groupism, politicalisation in the worst sense of our teachers, and tyrannies of small caesars." It has been increasingly felt that the whole process by which research is done requires to be carefully examined and rectified.

### **Necessity of Deeper Understanding of the Ongoing Processes of Research Production**

**1.16** The feeling that the provision of additional resources is necessary but that it alone is not sufficient to ensure improvement of quality and output of research has gained currency. It is often felt that the very freedom which distinguishes the atmosphere in the universities from that in the government laboratories tends to degenerate into lack of discipline, so that even the time available is not fully utilized, and, as a result, it is claimed that the universities cannot be entrusted to do anything on time. In the name of freedom to adopt personalised approaches in supervision, the commitment to provide adequate

guidance to the scholars is watered down. The value system involved in judging the merit of scholars and of the dissertations is also questioned. Problems of this kind are related to practices adopted by laboratories, processes of interaction between supervisors and scholars, perceived degree of trust with regard to recognition of merit, tolerance of slipshod work and even academic malpractices, and they can affect the quality, character and efficiency of the work being done.

**1.17** However, these problems have never been subjected to any degree of objective study as to the gravity and the extent to which they prevail. Impressionistic approaches have been adopted, and often scientists in command of national policies, who are mainly related to government research establishments, are content to simply underrate or even doubt the proficiency of university research. The professors are often complacent of the quality of their own work and critical of that of their colleagues. These superficial and subjective ways of assessing what is really going on in a large system, involving thousands of researchers placed in varying circumstances, are totally inadequate. Much of the thinking among university scientists who are concerned about such issues relates to conditions required for individual creativity to flourish. While the highly creative scientists are very important, scientific advance indeed depends on their contribution, their numbers anywhere in the world are very limited. They too have to face the general situation which prevails, and have to work in the midst of, and in cooperation with others of more limited intellectual capacity. If all facets of the environment of scientific research which prevails in university laboratories are improved, no doubt the highly creative would benefit, even to a degree more than the others.

### **The Nature and Scope of the Present Study**

**1.18** This kind of thought was responsible for the idea that the intimate processes of research, from the selection of the scholar and the problem, through every phase of the work, to the final evaluation of the thesis, should be studied. The study would have to be large enough so that its conclusions may have validity for the purpose of making suitable policy decisions. It would have to be designed in such way as to delve deeply into all aspects of the situation. It would have to explore sensitive issues – such as proper recognition of merit vis-a-vis many factors of favouritism and prejudice, or objectivity of investigation vis-a-vis plagiarism and manipulation of data, and come up with an analysis such as would convince the scientific community, who would itself have to participate in improving the system. Necessarily, such a study would have to be based on hard data, as well as information from searching questionnaires. Consequently, a proposal was



made to the CSIR to investigate the Quality, Character, and Efficiency of scientific research in the Universities and the Indian Institutes of Technology.

**1.19** It must be explained right away that the most common interpretation of quality is related to the worth of a piece of research in the body of scientific knowledge, and this, of course, can only be judged by examiners of theses or by peers such as the referees of the journals who receive the piece of work for publication. This kind of evaluation was not intended to be made by the present project as approved by the CSIR. Quality of research judged on this basis is reflected by either the record of publication or citation which is usually available. Similarly, efficiency, in common interpretation is related to costs of input, and measures of output. This is an area which has many inherent difficulties because the output cannot be quantified, particularly in terms of money. The inputs in the university system are difficult to identify exclusively with research activity, because many facilities such as that of the library or of computation are used for a variety of purposes. Even the personnel involved in research has other duties to perform. So, this kind of assessment of efficiency was also clearly excluded from the purview of this project. Character is an even more undefined word. It must be emphasised that there is still a large number of measures of quality, character and efficiency, which is amenable to a degree of quantification. For example, quality of facilities and services; quality of people entering upon research; quality of people conducting research; quality of supervisors, supervision and evaluation; quality of the value system in vogue; the atmosphere and motivation which prevail, subjective perceptions of quality of administration and organisation, etc. are all relevant to the determination of the quality of the research work carried out. Character in terms of pure, applicable or applied work, or strength of linkages with the research laboratories or industry, etc., the awareness of research activity of other workers in the same field of research and of priorities and thrusts established by government, and in terms of academic ethics is amenable to a good degree of quantification. Similarly, efficiency of the system is related to the amount of time people spend on research, to the drop out rates from the research streams, to systematic utilization of research, and to the speed with which administration handles the work of the university bodies. These factors are again measurable. In other words, leaving aside some specific measures of quality and efficiency, a lot of other very important aspects are capable of being investigated, and these aspects establish the overall environment in which research is being done. The study of these factors could lead to identifying specific weaknesses in the system and proposing of various kinds of remedies.

**1.20** The research methodology pursued is explained in some detail in the next chapter. But one aspect of collecting information was to direct a certain



number of specific queries to the institutions which form the representative group for conducting the study. In the course of this work, it became immediately obvious that the Education Commission in its Report of 1966 had rightly said in Para 16.45: "It is unfortunate that we have less information about some essential aspects of university research than about almost any other major aspect of education. This lack of information is perhaps both a cause and an effect of the relative neglect of university research within the framework of the nation's research activities and education." The Education Commission had suggested to the University Grants Commission to continuously produce objective information of research in India and its impact on Indian society, and a systematic study and comparison with developments in other countries, more significantly the USSR, USA, Japan and China. Even though the University Grants Commission has made some efforts to persuade the universities to collect and supply certain kinds of data to the Commission, the position is most unsatisfactory. Out of the 27 institutions which were queried about very ordinary kind of information (about research scholar's name, date of registration for research, dates of submission of theses and declaration of results, award of fellowships, etc.), practically none of the institutions had the information readily available. The CSIR had to agree to pay separately for collection of this information from dispersed files in the institutions, but in spite of this, and persistent reminders, the information from many institutions was deficient in some respects or failed to come altogether. Two questionnaires were developed and field tested to elicit information directly from supervisors and scholars with regard to personal data, process of research, performance of the system, environment or atmosphere of work, linkages and connectivity, and their various subjective perceptions, etc. Fortunately, there was very encouraging response to these questionnaires and a great deal of important information was collected through them. The honesty and sincerity with which the questionnaires were answered is borne out by the consistency of the responses with regard to a number of questions which were asked in different ways to cross check the responses. The sensitive questions have also been answered properly because of complete confidentiality which was ensured.

**1.21** Indeed, it is a remarkable feature of this research that institutions receiving very different levels of support, such as the Indian Institutes of Technology on the one hand and the state universities on the other, and those widely dispersed over the whole country, have provided responses from supervisors as well as scholars which bear great similarity. This gives confidence about the validity and reliability of the responses. At the same time, one is obliged to think that if the entire university research system has certain remarkable weaknesses which can only be attributed to the state of the scientific tradition in the country, or the prevailing culture, then similar

weaknesses are likely to be found outside the system, in the research laboratories of the country as well. It may even be that, at least some of the weaknesses, may figure in a more pronounced form in the latter case.

**1.22** There has been a lot of discussion with scientists as well as sociologists regarding the presentation of the data. Many of the questions were designed to be answered on a five point scale, but the five points each carried a clear adjective or set of alternative statements. In view of the fact that this entire research was carried out, not for the sake of curiosity alone, but in order to lead to certain kinds of action for improving the system, which in turn depends on the understanding and appreciation of the concerned scientists, it was decided to present the data in a simple and straightforward manner, without adducing weights to the various points on the scale or calculating averages. In this sense, the departure from the ordinary practice of reporting results of this kind of research was considered not only permissible but necessary. Different readers can arrive at their own conclusions from the study of the Tables which have been presented, and their conclusions may sometimes differ from those presented by the study, which is as it should be.

### **Acknowledgements**

**1.23** It is a pleasure to express gratitude to the Council of Scientific and Industrial Research for supporting this project and even encouraging it all the way along, including the publication of the results in the form of a book. The then Director General, Prof. A.P. Mitra is to be thanked personally for his clear understanding of the significance of this work and giving it his wholehearted support. The interest and advice of Prof. D.N. Misra who was at that time an Adviser to the CSIR is to be particularly mentioned. Prof. Misra, through the Advisory Committee, made many contributions to the design of this study. The Advisory Committee consisting of Prof. G.Ram Reddy, the then Vice-Chancellor of Indira Gandhi National Open University, Prof. P. N.Srivastava, the then member of the Planning Commission, Prof. D.N. Misra, Prof. G.D. Sharma, Senior Fellow, National Institute of Educational Planning and Administration, Prof. L.S. Kothari of the Physics Department of University of Delhi, Dr. S.P. Gupta, Additional Secretary, University Grants Commission, Dr. Ashok Jain, the Director, National Institute of Science, Technology and Development Studies is indeed responsible for a number of good ideas, suggestions and criticism.

**1.24** Special mention has to be made of two landmarks in the course of the study. These were the two seminars, one sponsored jointly by the National Institute of Science Technology and Development Studies (NISTADS) and the National Institute of Educational Planning and Administration (NIEPA)



was attended by a large number of experts who appreciated the data and its analysis and made constructive recommendations for improving the system. The other seminar was sponsored by the Society for Scientific Values and was again largely attended, particularly by Fellows of the Indian National Science Academy, and resulted in a very useful discussion of the results. These Seminars provided immense encouragement and new ideas for the study.

**1.25** The Indira Gandhi National Open University has to be thanked in particular for providing the infrastructure and space for this work. They were always solicitous and prompt about every facility needed for the Project. Prof. G. Ram Reddy and Prof. V.C. Kulandaiswamy, the past and present Vice-Chancellors are to be specially thanked. The CSIR provided the staff, the computer and the running expenses. The Project had Mrs Madhulika Rakesh, Research Associate, and Mrs Shreyosi Kanta and Miss Nupur Awasthi as Senior Fellows. These three very devoted scientists are indeed responsible for the main work, including personal visits to each of the 26 out of 27 institutions in order to obtain the responses of scholars through very persistent effort, pursuing them in laboratories, libraries, hostels and elsewhere in the campus. Their role in analysing the data and collating it for various seminars and for this final report has been most invaluable, and full credit should go to them. Their personal experiences of prolonged interaction with scholars in many institutions and their impressions of the atmosphere that permeates there have been recorded and this provides a very useful subjective commentary on what the questionnaires tried to assess objectively.

**1.26** While the CSIR paid for the research staff, the Indian Council of Social Science Research, through a National Fellowship provided support to the Principal Investigator, and they are to be thanked for their participation in this piece of research. Prof. Shakti R. Ahmed, the then Director of School of Sciences at the IGNOU was a Co-Principal Investigator and also a member of the Advisory Committee. Her role in conceiving of the project and at every stage of its progress, including critical reading of the manuscript is deeply appreciated. The project had admirable support from Mrs Pervesh Jain who gave all the time and effort which was to be invested in the project, kept the records, took the dictations, wrote the letters, and helped to prepare the manuscript for the book. Miss Neelam Sehgal, the only other assistant in the office, kept track of all the books and documents which were ever needed for reference, since material has a tendency to get out of its proper place. She entered the data on the computer, and helped to analyse the same, until finally she put the manuscript on the word processor. Her role in the whole Project has been most invaluable. Lastly, Mr Phurni Ram was the magic man producing tea or coffee for the team, at all hours and even when the electric power failed! Without this admirable and very congenial team this piece of work would not have been possible.



# Research Design and Methodology

### Delimitation of the Study

**2.01** The study entitled “Investigation on Quality, Character and Efficiency of Scientific Research in the Universities and Indian Institutes of Technology (IITs)”, sponsored by the Council of Scientific and Industrial Research (CSIR), was designed in some detail with the help of an Advisory Committee, which has been referred to in the previous Chapter. Greater definition was given to it by the Principal Investigator as the work got along. One of the first decisions of the Committee was to clearly demarcate the scope of the study. It was decided that the words Quality, Character and Efficiency would be interpreted in a limited manner so as to exclude the more conventional aspects, particularly of quality in terms of value of a piece of scientific research in the body of scientific knowledge, and considerations of any kind of input output analysis related to efficiency. On the positive side, the interpretation of these words would include a number of components which could be quantified and measured. These are reflected, by and large, in the two sets of questionnaires which were designed and which are appended to this publication.

**2.02** It was also decided that all the universities could not be covered by a study which would have to be completed in about three years time. If an all inclusive study were to be made, it would not only come up against insuperable difficulties with regard to the availability of data and information from the very large number of institutions, but it would also take, perhaps, six or seven years to complete and by the time it is in a shape to be published, it would be hopelessly out of date. Hence a carefully structured and representative sample of 27 institutions was drawn up. A list of these institutions is given below.

### LIST OF 27 SAMPLE INSTITUTIONS

#### A. Central Universities (CU)

1. Aligarh Muslim University, Aligarh

2. Banaras Hindu University, Varanasi
3. University of Delhi, Delhi
4. North Eastern Hill University, Shillong
5. Panjab University, Chandigarh
6. Indian Institute of Science, Bangalore

#### **B. State Universities (SU)**

1. University of Allahabad, Allahabad
2. Andhra University, Waltair
3. Bangalore University, Bangalore
4. Bhopal Vishwavidyalaya, Bhopal
5. University of Bombay, Bombay
6. Gujarat University, Ahmedabad
7. Jadavpur University, Calcutta
8. University of Jammu, Jammu
9. Madurai-Kamraj University, Madurai
10. Marathwada University, Aurangabad
11. Meerut University, Meerut
12. Osmania University, Hyderabad
13. Patna University, Patna
14. University of Poona, Pune
15. University of Rajasthan, Jaipur
16. Utkal University, Bhubaneswar

#### **C. Indian Institutes of Technology (IIT)**

1. Bombay
2. Delhi
3. Kanpur
4. Kharagpur
5. Madras

**2.03** It contains six "Central Universities" (CU) which are entirely financed through the University Grants Commission (UGC) and which receive somewhat better financial support than the State Universities (SU). The Indian Institute of Science, Bangalore (IISc) and Panjab University, Chandigarh, although administered in a slightly different manner, are still put in the category of Central Universities because of the level of support they receive and the freedom they enjoy. In fact, since it is acknowledged to be a top ranking research institution, the IISc has often been used in tabulated data as a sort of bench mark. The singling out of the IISc is believed to be justified. Sixteen State Universities were selected, out of a very large number, with due regard to regional distribution. These universities receive their

maintenance grants from the States, although the development assistance is provided to them by the UGC. The level of support is generally perceived to be deficient and subject to unwelcome administrative controls of the State Governments. The five IITs were all put on the selected list because of their small number. In the case of the Central and State Universities, the choice was also governed by the consideration of including some older and well established institutions known to be active in the field of scientific research, and some newer institutions which are in the process of coming up. The

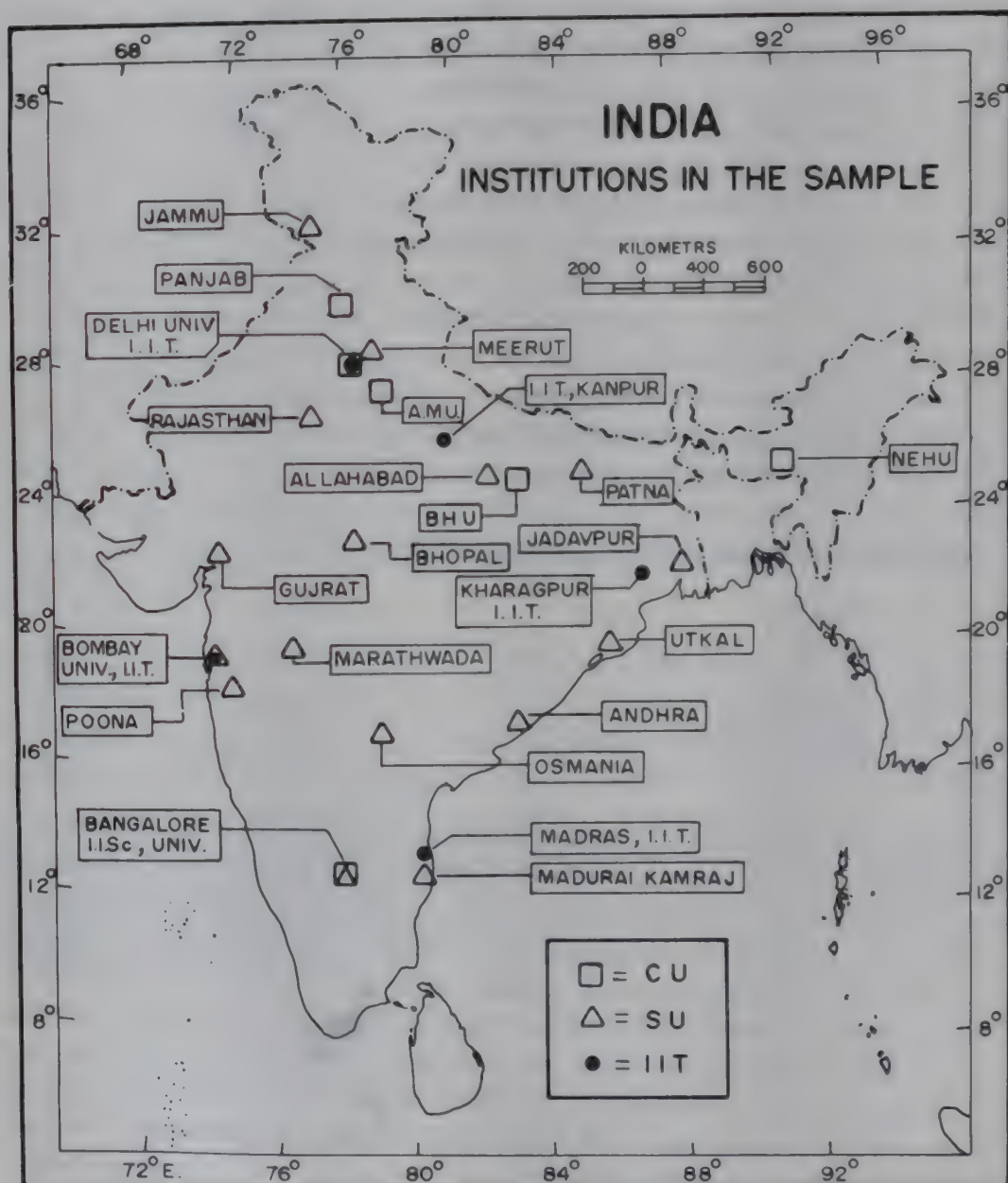


Fig. 2.1



geographical distribution is shown in the map. It may be noted that the Agricultural Universities and Medical Institutions are not included in the study, although they have active research groups in the basic sciences.

### **Avenues of Exploration**

**2.04** It was decided to pursue mainly four avenues of exploration. The one would be to obtain information from the institutions regarding persons who registered for research between the years 1975 and 1985, indicating generally the time they took in completing their research for the Ph.D. degree. Complete data of this kind was expected to show any migration from one university to another for research; it would indicate drop out rates in various subjects, and enable an analysis to be made of time taken by various stages of research and its evaluation. The second and the third components would be carefully designed and field tested questionnaires to be developed for obtaining information, opinions and perceptions from supervisors and scholars in these 27 institutions. All the intimate and significant happenings in the course of research could be studied from the responses to these questionnaires. The questionnaires to the supervisors could be sent by mail because the addresses of the supervisors could be obtained from the 'Universities Handbook' published by the 'Association of Indian Universities' which gives particulars of all the universities and the IITs in the country. Since the names of the scholars are not available anywhere they would have to be approached personally through the research staff of the Project by visiting the institutions concerned. The fourth aspect would be an analysis of the results of the Junior Research Fellowship (selection) examination conducted jointly by the CSIR and the UGC which could throw some light on the quality of the joining research. These examinations are taken by thousands of students every year and the results of the examinations provide an overall comparative picture of the instructional standards prevailing in the institutions. Other data and information was to be obtained from existing reports of the various agencies with regard to their support for scientific research, and their evaluation of this work, if any.

**2.05** The 27 institutions which were selected included 179 departments of science, which in our university system largely relate to Physics, Chemistry, Bio-Sciences, Zoology, Botany, Geo-Sciences, Mathematics and Statistics. All the institutions do not have all the departments. Out of the 179 departments, many receive special research support from the UGC in recognition of their performance. In the order of the magnitude of this support, 39 departments are said to be "COSIST" assisted (COSIST, standing for Committee to Support Infrastructure of Science and Technology, set up on the initiative of the Planning Commission and the UGC), 17 of them are

called Centres of Advanced Study, 24 are known as Departments of Special Assistance, and 17 as Departments of General Research Support. Thus, out of 179 departments which are included in this study, 97 are departments which have been identified to be more active than the others, and in some ways more capable of absorbing enhanced support. The departments of science in the IITs are also known to be at least at the same level as the 34 Departments of Special Assistance. The sample, that we have, on the whole, therefore, represents a better than average picture of the science departments in the system. 15% of enrolment for research in the universities is in the affiliated colleges but this sector has also been excluded.

**2.06** The data pertaining to the research scholars registered between 1975-85 was of a kind which, it was expected, the institutions would be able to supply without any difficulty and it was expected that particulars of about 15,000 scholars would be available. But, in fact, a great deal of difficulty was experienced in obtaining the data from the institutions since they all lack consolidated registers giving full particulars of their research scholars in regard to the original university and the year and division of obtaining the qualifying degree, date of registration for the Ph.D. degree, date of submission of thesis, date of receiving the report of the last examiner, date of holding the final viva-voce examination and date of declaration of the result, etc. Information about scholarships or fellowships was also not easily available. Finally, it was possible to obtain data on 9907 scholars, complete in respect of all details. This is, fortunately, a large enough number to yield dependable results.

**2.07** The questionnaires to the supervisors were sent out, in 1987-88, to 2000 Professors and Readers in the selected institutions because their names alone are mentioned in the document from which the addresses were obtained. We have very few responses from the younger teachers. The total number of responses was 829, and these senior members of staff among them had supervised 7717 scholars, had examined 8981 theses and were currently guiding 2795 scholars. Among the supervisors, 511 were Professors, 278 Readers and 38 Lecturers. Nine of these persons have received the prestigious Hari Om Award, twenty-five the Bhatnagar Award, One hundred and sixty-two have various other distinctions such as the Fellowship of the Indian National Science Academy. The responses of 829 supervisors, in the total expected number of 9000 supervisors in the university system, represents a 9% sample. In view of the vast experience of research supervision and examination of theses represented by this group, the information and perceptions offered by these supervisors should be accorded a high degree of credibility. The institutional affiliation and other particulars of the supervisors are given in Table 2.01.



**2.08** The responses of 2072 scholars from the same set of institutions were obtained between January 1988 and February 1990. The institutional affiliation of these scholars is given in Table 2.02 and the number 2072 represents about 10% of all scholars in the science faculties of all the universities. Once again the sample is large enough to provide a high degree of credibility to the responses obtained.

**2.09** The size of the data obtained through the questionnaires is so large that even if we segregate it subject-wise and institution-wise, we would still have large numbers to give the results a good degree of reliability. The cross-checked opinions of supervisors and scholars in such large numbers about conditions and procedures in the given set of institutions should lead to fairly accurate judgement about what is happening in respect of scientific research in the institutions.

**Table 2.01 : Category-wise Distribution of Sample Supervisors**

| Institution | Number | Designation | Number | Award              | Number | Sex    | Number |
|-------------|--------|-------------|--------|--------------------|--------|--------|--------|
| CU          | 307    | Professor   | 511    | Bhatnagar Award    | 25     | Male   | 775    |
| SU          | 392    | Reader      | 278    | Hari Om Award      | 9      | Female | 52     |
| IITs        | 96     | Lecturer    | 38     | Other Distinctions | 162    | —      | —      |
| IISc        | 34     | —           | —      | —                  | —      | —      | —      |
| Total       | 829    |             | 827    |                    | 196    |        | 829    |

**Table 2.02 : Category-wise Distribution of Scholars**

| Institution | Number | With Fellowship<br>(Number/Percentage) | Without Fellowship<br>(Number/Percentage) | Sex    | Number |
|-------------|--------|----------------------------------------|-------------------------------------------|--------|--------|
| CU          | 670    | 487/72                                 | 186/28                                    | Male   | 1376   |
| SU          | 873    | 587/67                                 | 286/33                                    | Female | 696    |
| IITs        | 282    | 264/94                                 | 18/6                                      | —      | —      |
| IISc        | 247    | 231/94                                 | 16/6                                      | —      | —      |
| Total       | 2072   | 1566/76                                | 505/24                                    |        | 2072   |

### The Nature of the Questionnaires

**2.10** The questionnaires obtained information on the individuals who filled them and all the details of the activities which they pursued. Questions related to how research problems were selected, what was their nature, how research scholars were guided, how facilities were shared, what support from and linkages with other institutions or industry/agriculture were in operation, and many other aspects of infrastructure or facilities. The supervisors were



asked about their perceptions of the academic background and performance of their scholars, and vice-versa, the scholars were asked about the supervisors. Very sensitive, but extremely important, questions about due recognition of merit and the value system in operation, and about various malpractices, were also asked and for the first time there is at least some assessment of the situation on these points.

**2.11** In most cases a five point scale was used with suitable adjectives or alternate statements. There were many sensitive questions which people were not likely to answer freely and frankly, and in such cases great care was taken to phrase them properly so that nobody would appear like incriminating or condemning anyone else, just as care was taken to maintain total confidentiality. Since the questionnaires were in English, care was taken to make the language simple and understandable in the Indian context. The questionnaire for the scholars was field tested in one of the universities which was not in the sample, and modifications were made as a result of this preliminary interaction with scholars. There may still be ambiguities and some problems regarding the interpretation of the meaning of the questions, but the size of the data obtained encourages us to feel confident that the aberrations would have a negligible overall effect.

**2.12** For the rest of the information, the results of the CSIR-UGC tests were obtained from these agencies. Unfortunately, no usable data on the agencies' own evaluation of the projects sponsored by them was available.

### **Additional Input**

**2.13** It may be mentioned here that since the research staff had to visit the universities and the IITs for interaction with the scholars and obtaining their responses to the questionnaires, they had a unique opportunity of meeting and talking to thousands of research scholars in these 27 institutions. The staff had prepared themselves for the purpose. They had also been asked to record their personal impression of the places, the activities and the spirit of the research supervisors and scholars. Since two of the staff of the Project visited each of the institutions, they were asked to write separate reports. The file now contains about 50 very frank and revealing reports. The scholars, particularly, spoke without reserve with the young team of the Project (of the same age as the scholars), in informal chats over cups of tea, and, therefore, these reports provide a very perceptive input on the scientific and human factors which influence research.

## CHAPTER III

# A Study of the Research Scholars

### General Data

**3.01** In the first instance some data is presented on the male/female distribution of the scholars who have responded to the questionnaire. The Table 3.01 gives the distribution; in each case, the first figure is the number and the second, the percentage of the total.

**3.02** It appears that one third of the scholars are female, and approximately the same percentage is found in all the institutions, except in the Indian

**Table 3.01 : Male/Female Distribution  
(Number/Percentage)**

| Category | Valid Reply | Male    | Female |
|----------|-------------|---------|--------|
| CU       | 670/32      | 447/67  | 223/33 |
| SU       | 873/42      | 548/63  | 325/37 |
| IIT      | 282/14      | 196/70  | 86/30  |
| IISc     | 247/12      | 185/75  | 62/25  |
| Total    | 2072        | 1376/66 | 696/34 |

**Table 3.02 : Accommodation  
(Number/Percentage)**

| Category | Valid Reply | No Reply | Hostel  | Own House | Rented House |
|----------|-------------|----------|---------|-----------|--------------|
| CU       | 645/96      | 25/4     | 366/57  | 129/20    | 150/23       |
| SU       | 948/97      | 25/3     | 300/35  | 268/32    | 280/33       |
| IIT      | 275/98      | 7/2      | 231/84  | 18/7      | 26/9         |
| IISc     | 245/99      | 2/1      | 222/91  | 13/5      | 10/4         |
| Total    | 2013/97     | 59/3     | 1119/56 | 428/21    | 466/23       |

Institute of Science, which is a research institute without postgraduate classes in science and where the proportion of women scholars is only 25%. The residential status is given in Table 3.02 and it appears that in the IITs and the IISc a very large proportion of scholars lives in hostels, whereas in the Central universities, only 57% and in the State universities, 35% live in hostels. A large number of scholars in the Central and State universities live in their own houses and in rented houses. The marital status of the scholars is given in Table 3.03 which shows that in the Central and State universities,

**Table 3.03 : Marital Status  
(Number/Percentage)**

| Category | Married | Unmarried |
|----------|---------|-----------|
| CU       | 175/26  | 495/74    |
| SU       | 198/23  | 675/77    |
| IIT      | 38/13   | 244/87    |
| IISc     | 32/13   | 215/87    |
| Total    | 443/21  | 1629/79   |

nearly 25% of the scholars are married, which is not the case in the IITs and the Indian Institute of Science.

**3.03** The average age which is given in the next Table 3.04, is around 29 years, which indicates that by the time research is completed, the scholars

**Table 3.04 : Average Age  
(In Years)**

| Category | Men | Women |
|----------|-----|-------|
| CU       | 28  | 30    |
| SU       | 30  | 29    |
| IIT      | 29  | 29    |
| IISc     | 29  | 31    |

would be around 32 years of age, whereas, the average age at the entry to the Ph.D programme is, therefore, around 26 years. What is noteworthy is that the average age of women in research is about the same as that of men.

### **Sociological Background**

**3.04** The analysis of the sociological background has been made on the basis of the educational level of the parents, and whether the parents normally



live in a village, town or a big city, etc., and further, on the basis of the guardian's profession. These factors reflect on the nature of the academic environment in which the scholars have been brought up. Table 3.05 gives the level of education of fathers and mothers. It is remarkable that about 4% of the scholars have illiterate fathers and 12% have illiterate mothers. Therefore, the proportion of first generation learners in this sample of the research scholars, which might indicate the distribution as a whole, shows that more than 10% are first generation learners. Furthermore, if one draws the line at the completion of 12 years of schooling, then 40% of the fathers are at that level and 78% of the mothers are at that level. The postgraduates and professionals amongst fathers account for only 34% and amongst mothers for only 8%. It is of interest to see that all kinds of institutions have practically the same status of parental education. Research scholars seem to have a single pattern of parental education all over the country. In the Indian social situation one would say that the bulk of the research scholars come from families which do not have strong academic background, and

**Table 3.05 : Level of Parents' Education**  
(Number/Percentage)

|               | CU     | SU     | IIT    | IISc   | Total   |
|---------------|--------|--------|--------|--------|---------|
| <b>FATHER</b> |        |        |        |        |         |
| Illiterate    | 31/5   | 37/4   | 8/3    | 7/3    | 83/4    |
| Middle Pass   | 60/9   | 103/12 | 28/10  | 21/9   | 212/10  |
| High School   | 67/10  | 92/11  | 52/19  | 28/12  | 239/12  |
| Intermediate  | 88/13  | 119/14 | 49/18  | 38/16  | 294/14  |
| Graduate      | 169/26 | 215/25 | 67/24  | 71/29  | 522/26  |
| Post-Graduate | 135/21 | 162/19 | 34/12  | 32/13  | 363/18  |
| Professional  | 105/16 | 137/16 | 39/14  | 44/18  | 325/16  |
| No Reply      | 15/2   | 8/1    | 5/2    | 6/2    | 34/2    |
| Valid Reply   | 655/98 | 865/99 | 277/88 | 241/98 | 2038/98 |
| <b>MOTHER</b> |        |        |        |        |         |
| Illiterate    | 102/15 | 107/12 | 28/10  | 18/7   | 255/12  |
| Middle Pass   | 176/27 | 251/29 | 71/26  | 59/24  | 557/27  |
| High School   | 149/23 | 213/25 | 72/26  | 69/28  | 503/25  |
| Intermediate  | 80/12  | 112/13 | 44/16  | 44/18  | 280/14  |
| Graduate      | 109/16 | 113/13 | 36/13  | 26/11  | 284/14  |
| Post-Graduate | 38/6   | 60/7   | 23/8   | 25/10  | 146/7   |
| Professional  | 7/1    | 4/0    | 3/1    | 2/1    | 16/1    |
| No Reply      | 9/1    | 13/2   | 5/2    | 4/2    | 31/1    |
| Valid Reply   | 661/99 | 860/98 | 277/98 | 243/98 | 2041/99 |

access to extra-curricular materials, particularly books and magazines, is limited.

**3.05** Table 3.06 giving the residence of the parents also indicates a great deal of uniformity across institutions. 25% of the scholars who have parents normally living in villages, small towns and small cities, also have an atmosphere of life which is quite akin to rural areas, and if one takes both

**Table 3.06 : Parents' Residence**  
(Number/Percentage)

|             | CU     | SU     | IIT    | IISc   | Total   |
|-------------|--------|--------|--------|--------|---------|
| Village     | 179/27 | 217/25 | 69/25  | 41/17  | 506/25  |
| Town        | 118/18 | 200/23 | 68/25  | 64/26  | 450/22  |
| Small City  | 125/19 | 125/14 | 37/13  | 29/12  | 316/15  |
| Big City    | 118/21 | 249/29 | 56/20  | 64/26  | 507/25  |
| Metropolis  | 95/15  | 75/9   | 47/17  | 45/18  | 262/11  |
| No Reply    | 15/2   | 7/1    | 5/2    | 4/2    | 31/1    |
| Valid Reply | 655/98 | 866/99 | 277/98 | 243/98 | 2041/99 |

these groups into consideration, about 60% of scholars have their parents living either in a village, town or a small city. The big cities and the metropolis account for only 38%.

**3.06** The guardian's professions are given in Table 3.07 and the professions are in the order in which the humblest comes first and the successive categories become more sophisticated. The farmers, the skilled or technical workers

**Table 3.07 : Guardian's Profession**  
(Number/Percentage)

|                              | CU     | SU     | IIT    | IISc   | Total   |
|------------------------------|--------|--------|--------|--------|---------|
| Farmer                       | 112/17 | 130/18 | 34/14  | 27/15  | 303/17  |
| Skilled/Technical Worker     | 25/3   | 25/4   | 15/6   | 3/2    | 68/4    |
| Trader                       | 25/4   | 18/3   | 9/4    | 6/3    | 58/3    |
| Clerical/Office Worker       | 52/9   | 81/11  | 44/18  | 24/13  | 201/11  |
| Teaching/Research            | 126/21 | 131/19 | 39/16  | 44/24  | 340/19  |
| Officer in Govt./Pvt. Office | 191/31 | 214/13 | 80/33  | 60/33  | 545/31  |
| Business/Lawyer/Doctor       | 90/13  | 106/15 | 24/10  | 19/10  | 239/14  |
| MLA/MLC/MP, etc.             | 6/1    | 3      | 1      | 1/1    | 11/1    |
| Industrialist                | 0      | 0      | 0      | 0      | 0       |
| No Reply                     | 43/6   | 165/19 | 36/13  | 63/26  | 307/15  |
| Valid Reply                  | 627/94 | 708/81 | 246/87 | 184/74 | 1765/85 |



(something like mistries), the traders (something like small shopkeepers), and the clerks or office workers account for 35% of the whole lot.

**3.07** All the institutions seem to be in a very similar situation. It is notable that there are hardly any children of politicians and industrialists who are doing research in the universities and the IITs.

**3.08** It appears from this Table that there are about 19% children of people who are in teaching/research, but when this group is examined for the educational background of the parents, it turns out that out of 340 such cases, only 211 are post-graduates and in the various professions. On examining the normal place of residence of parents who are engaged in teaching/research, it appears that only 183 out of 340 live either in a small city or in a big city or metropolis. Therefore, one can surmise that only half the number of guardians, which is in professions said to be teaching or research, could possibly be college or university teachers. This implies that the sons and daughters of college or university teachers account for less than 10% of the total research scholars.

**3.09** While, sociologically it is a welcome feature that the highest level of education has permeated to families where level of education of the parents is very low, where parents are engaged in minor professions or farming, and they normally live in out-of-the-way small towns or villages, we cannot overlook the fact that this group has limited exposure to the world of books to learn from, or well informed debates and discussions at home, and very likely, it has received schooling in institutions, deficient in a variety of ways. It may be that in such a group, imagination, quest for excellence and courage to go off the beaten track, may not be strong. From the point of view of research potential, the likelihood is that these young people would need a very strong and special educational programme to make them truly creative. In the Indian situation, people of this kind of background, for no fault of theirs, are deprived, particularly of linguistic and communication skills which are so important for pursuing research. It may be emphasised that about 35% of the students do not fit into this description, and when a child from deprived educational background struggles for competitive admission to higher classes to reach the level of research, then he or she may indeed have developed the faculties necessary for pursuing research.

### **Academic Background of Scholars**

**3.10** In the Indian universities results are announced in terms of divisions. The top ranking students are put in the first division and these are usually those who have obtained more than 60% marks in the qualifying examination. Medium level students are put in the second division, their marks are between



50 and 60%. The percentage of first and second divisioners, amongst those who have responded to the questionnaire and are currently doing research, given in Table 3.08, reveals that the vast majority of researchers obtained

**Table 3.08 : Percentage of I and II Divisioners**

|        |    | CU | SU | IIT |
|--------|----|----|----|-----|
| B.Sc.  | I  | 73 | 80 | 90  |
|        | II | 27 | 20 | 10  |
| M.Sc.  | I  | 85 | 82 | 96  |
|        | II | 15 | 18 | 4   |
| M.Phil | I  | 97 | 94 | 0   |
|        | II | 3  | 5  | 0   |

a first division both in the M.Sc. and the B.Sc. examinations. The Table also tells us that more of the same group of students generally obtained first division in the M.Sc. than in B.Sc. The percentage of second divisioners involved in research in the Central and State universities is much higher than in the Indian Institutes of Technology. This is because IITs have hardly any M.Sc. output of their own and hence they can select scholars for Ph.D. without local consideration. We also have the data on this point for the period 1975 to 1985, for the M.Sc. examination only, and it is given in Table 3.09.

**Table 3.09 : Division Distribution in Qualifying Exam  
(Year of Registration 1975 - 85)**

|     | Valid Data | First      | Second     |
|-----|------------|------------|------------|
| CU  | 2018       | 1658 (82%) | 360 (18%)  |
| SU  | 3197       | 1850 (58%) | 1347 (42%) |
| IIT | 917        | 841 (92%)  | 76 (8%)    |

This data is on a much larger sample because it pertains to the research scholars who worked in the time span of 10 years. This data also shows that in the IITs, first divisioners account for 92%, whereas in the State universities, they account for only 58%. If one goes by percentages indicated in these Tables, 3.08 and 3.09, one would conclude that the general quality of scholars in the State universities may have improved, because while for the current scholars, the percentages of first and second divisioners are 82 and 18, for the past decade (1975 to 1985), the percentages are 58 and 42, respectively.

### **Analysis of CSIR-UGC JRF Tests**

**3.11** The reliability of the percentage of marks obtained in the university examinations, and therefore, of the divisions is, however, doubtful as borne out by an analysis of the CSIR-UGC Junior Research Fellowship tests. These tests were introduced by the CSIR in 1983, and by the UGC in 1984 and

for the last few years they have been conducted jointly by the CSIR and the UGC. The test consists of a minor component which could be called a mental ability test, and a major component based on a core curriculum for the master's degree and some specialised areas in the various subjects. The standard of the papers, which are framed mostly by professors from the universities is not at a pace setting level, but at the level of finding an average common performance of students from the large number of Indian universities and the Indian Institutes of Technology. Five tests, conducted between 1983 and 1987, lead one to the analysis which is shown in Table 3.10.

**Table 3.10 : CSIR/CSIR-UGC JRF Test Results' Summary (1983 to 1986)**

|                                                                                                                                        |         |
|----------------------------------------------------------------------------------------------------------------------------------------|---------|
| Total number of candidates in five tests                                                                                               | 27,467# |
| 75% to 80% of candidates are Ist Divisioners, number:                                                                                  | 21,150  |
| Number who obtained 60% in tests                                                                                                       | 174     |
| When 10% are declared successful, 35% to 40% mark level is reached                                                                     |         |
| 29% Ist divisioners obtained below 20% in 1986 test for which data is available                                                        |         |
| Average marks in subject paper, in five tests range between 13% in Statistics and 28% in Physics                                       |         |
| Similar performance of female and male candidates in all subjects                                                                      |         |
| No significant difference in the performance of candidates making first attempt and those who have taken the examination once earlier. |         |

# This number consists of two tests in 1983 and one each in 1984, 1985 and 1986.

According to this Table, out of nearly 21,150 students who had obtained above 60% marks in the Indian universities, only 174 managed to get 60% marks in the test. Even at the very low cut-off marks of between 35% and 40%, only 10% of all the students were able to qualify. Nearly 29% of the first divisioners scored below 20% marks in 1986 test for which such analysis has been made. The nature of the test has recently been slightly modified, but even in the test of which results were declared in 1990, out of 27,431 candidates who appeared, only 1,290 could qualify with a cut-off as low as 40%. Again out of this huge number of students, only 65 were able to score more than 60% marks. The average percentage of marks obtained in the subject related paper, was found to be as low as 13% in Statistics in one of the years, and as high as only 28% in Physics in one of the years.

**3.12** The poor performance, year after year, from some of the best universities, is obviously a matter of great concern and it reflects on the general quality of education provided in the universities at the master's level. The papers for these tests are based on short answer questions which require brief but very specific answers, whereas university examinations have questions generally of the long essay type. In the test, all questions are to be answered, whereas in the university examinations, there are plenty



of choices, and the predictability of the questions is high, since questions appearing in one examination are usually not repeated in the next examination. This leads to selective study, or leaving out, by students, of some portions of the curriculum altogether. The percentage of marks obtained is further affected by the fact that the practical examinations fetch disproportionately high marks.

**3.13** From the point of view of predictability of performance in research, even the UGC-CSIR examination is inadequate and needs to be improved upon in many possible ways. Leaving out the laboratory work and competencies required thereat, is a handicap of the tests and perhaps in future something will be done to improve matters in this respect. If aptitude for scientific research or creative activity could be assessed, it would add to the value of the test, but this is known to be quite difficult. Nevertheless, the disparity between university results and the results of the Junior Research Fellowship test is glaring.

**3.14** Various other kinds of analysis of these tests have been made which show that students from only half a dozen departments perform consistently well year after year. Some university departments have a consistently poor performance, but sometimes the same departments appear in both categories meaning that there is a large spectrum over which the quality of students lies in a single department. When the performance of male and female students was compared, no consistent difference could be discerned. It was also found that there was no consistent improvement in performance of the students appearing for the first time and a second time.

**3.15** The questionnaires to the supervisors as well as the scholars contained the question: "How many of the top ranking students, studied with you/known to you, are doing research?" The responses are tabulated in Table 3.11.

**Table 3.11 : How Many Toppers are Doing Research with You  
(Perceptions of Scholars/Supervisors in Percentage)**

|             | Valid Reply | No Reply | None | A Few | Some | Many | All |
|-------------|-------------|----------|------|-------|------|------|-----|
| Scholars    | 97          | 3        | 17   | 43    | 20   | 15   | 5   |
| Supervisors | 98          | 2        | 6    | 39    | 31   | 20   | 4   |

**3.16** The first point to be noted is that in such a question where the number is being guessed, there is still a good deal of similarity between the perception of supervisors and scholars. The scores are highest in the columns for "few" or "some", with "few" being definitely a more favoured answer. Perhaps the best statement would be that a minority of top ranking students take up research.



**3.17** It is worth noting that in the institution-wise analysis of the same data, according to the perception of scholars, the Indian Institutes of Technology, Central and State universities are all in a similar situation, but according to the supervisors, the IITs and the IISc have a higher percentage of top ranking students working there. This may not be very relevant because only in a few cases do the IITs have master's level classes, and the IISc has no master's level classes enabling supervisors to judge whether their top ranking students join research.

### Perception of Supervisors Regarding Scholars

**3.18** Having studied the sociological background and the likely deficiencies in the educational exposure of the bulk of the research scholars, it is worthwhile to examine the opinion of the supervisors regarding some important characteristics of the scholars. The data with respect to all the disciplines, that is supervisors/scholars of all subjects, has been analysed but no remarkable difference has been noticed in this regard. Therefore, in the Tables given below, all the subjects have been clubbed together.

**3.19** The first question asked was how many of your research scholars were imaginative and enthusiastic, and the analysis given in Table 3.12(a) shows the response. It seems that if "hardly any" and "a few" are considered as a

**Table 3.12(a) : The Imaginative and Enthusiastic Scholars Doing Research  
(Supervisors' Perception in Percentage)**

| Category | No Response | Hardly Any | A Few | Quite A few | Most | All |
|----------|-------------|------------|-------|-------------|------|-----|
| CU       | 19          | 19         | 41    | 23          | 15   | 2   |
| SU       | 6           | 12         | 47    | 20          | 15   | 5   |
| IIT      | 4           | 9          | 30    | 38          | 17   | 5   |
| IISc     | 3           | 6          | 30    | 39          | 21   | 3   |
| Total    | 7           | 14         | 42    | 24          | 15   | 4   |

negative response, then 56% of the supervisors found scholars "low" on being imaginative and enthusiastic, and on the other hand, only about 19% could be classified as "high" in this characteristic. As many as 24% are in the gray zone, and perhaps half this percentage could go on either side. Again these are not percentages of scholars counted for this quality but percentages deduced from the supervisor responses, who were presumably commenting about the scholars who are in contact with them. It is found that the universities and the IITs are in a very similar position, that is, their scores are close to the common average.

**3.20** Table 3.12(b) is in response to the question : “How many of your scholars are poor in experimental skills?” Here, looking at the totals,

**Table 3.12(b) : The Scholars Poor in Experimental Skill  
(Supervisors’ Response in Percentage)**

| Category | No Response | Hardly Any | A Few | Quite A Few | Most | All |
|----------|-------------|------------|-------|-------------|------|-----|
| CU       | 33          | 39         | 33    | 14          | 10   | 4   |
| SU       | 25          | 47         | 38    | 10          | 4    | 2   |
| IIT      | 46          | 52         | 26    | 10          | 10   | 2   |
| IISc     | 18          | 36         | 46    | 7           | 7    | 4   |
| Total    | 27          | 44         | 35    | 11          | 7    | 3   |

one finds that the percentage of no reply is very high, 27%, and that is understandable, because the statement implies a negative character of scholars working under supervisors. In this response : “A few” has to be counted as a negative statement to the extent of half the numbers and thus 35% of the scholars can be said to be poor in experimental skills. If the hesitation of a large number of supervisors to commit their opinion is taken into account, perhaps half the supervisors can be said to find their scholars poor in experimental skills. In this manner of analysis, the scholars of the State and Central universities are poorer in experimental skills than the scholars in the IITs. Obviously, this reflects on the quality of laboratory work done in the masters’ courses and shows that the preparation for research in the experimental field is inadequate.

**3.21** The supervisors were asked the question as to how many of their scholars were poor in ability to write a scientific report or to comprehend scientific literature. The response is depicted below in Table 3.12(c). No response is quite high because supervisors in some cases have avoided

**Table 3.12(c) : The Scholars Poor in Ability to Write a Scientific Report or to Comprehend Literature  
(Supervisors’ Response in Percentage)**

| Category | No Response | Hardly Any | A Few | Quite A Few | Most | All |
|----------|-------------|------------|-------|-------------|------|-----|
| CU       | 19          | 15         | 33    | 27          | 18   | 6   |
| SU       | 14          | 15         | 35    | 24          | 20   | 6   |
| IIT      | 8           | 25         | 37    | 19          | 14   | 5   |
| IISc     | 18          | 14         | 46    | 18          | 21   | —   |
| Total    | 12          | 16         | 35    | 25          | 19   | 5   |

commenting on the poor abilities of their scholars. Even so, it is seen that if we include the last two columns in the category of serious deficiency, clearly 24% of the supervisors perceive that scholars are poor in ability to write a scientific report or to comprehend literature. The actual percentage would be even higher if half of the 25% of the supervisors with the response "quite a few" are counted as rating their scholars poor in the ability. On account of high non-response, one could infer that around 40% supervisors accord poor rating to this ability, perhaps representing 40% scholars. Detailed data indicates that the scholars in the IITs fare a little better than the others.

**3.22** When the question asked was more pointed and the supervisors had to say how many of their scholars are not cut out for research, the results were as shown in Table 3.12(d) and no response became higher, i.e. 21%.

**Table 3.12(d) : The Scholars Not Cut Out for Research  
(Supervisors' Response in Percentage)**

| Category | No Response | Hardly Any | A Few | Quite A Few | Most | All |
|----------|-------------|------------|-------|-------------|------|-----|
| CU       | 31          | 50         | 27    | 11          | 9    | 3   |
| SU       | 22          | 52         | 32    | 10          | 4    | 2   |
| IIT      | 14          | 67         | 19    | 8           | 5    | —   |
| IISc     | 18          | 61         | 32    | -           | 4    | 4   |
| Total    | 21          | 54         | 29    | 9           | 6    | 2   |

At least 8% of the supervisors responded that the scholars in their experience were not cut out for research. A further 4% contribution to this category comes from the gray zone. But this percentage is also likely to be an underestimate because of 21% supervisors withholding opinion. A good 20% to 25% scholars may be unfit for research.

**3.23** Three other questions confirm the data which is shown altogether in Table 3.12(e). On the question of scholars being "sincere and hard working",

**Table 3.12(e) : Scholars Having Following Characteristics  
(Perception of Supervisors in Percentage)**

| Characteristics                      | No Response | Hardly Any | A Few | Quite A Few | Most | All |
|--------------------------------------|-------------|------------|-------|-------------|------|-----|
| Sincere and Hard Working             | 4           | 4          | 21    | 23          | 35   | 17  |
| Weak Foundation but Willing to Learn | 10          | 18         | 38    | 20          | 19   | 5   |
| Elusive and Shirking Work            | 16          | 68         | 21    | 7           | 3    | 1   |



it is revealing that only 52% of the supervisors have answered either “most” or “all”. On the other hand, 25% have said that there are hardly any or a few sincere and hard working scholars. Among the institutions, the IISc was an exception with 12% supervisors saying that either “most” or “all” the scholars were sincere and hard working. “How many scholars had weak foundation but were willing to learn” elicited a response of about 24% in the categories “most” or “all” taken together. Half of 20% in the middle category would make the negative feature 34%. Another question was about how many of the scholars are elusive and they shirk work. On this question no response went up to 16% because of the strongly negative opinion involved. But only 68% of the responding supervisors said “hardly any”. The opinion in all the institutions is practically the same on this score. On the whole, it appears that about 15% supervisors feel that scholars are elusive and shirk hard work.

**3.24** An analogous set of questions asked was related to the attitudes, working style and depth of knowledge of the scholars. Tables 3.13, 3.14 and 3.15 are based on the responses of the supervisors. Table 3.13 refers to a

**Table 3.13 : Scholars' Attitude towards Research  
(Perception of Supervisors)  
(Number/Percentage)**

|       | Valid Reply | No Reply | Extremely<br>Casual | Slightly<br>Casual | Serious | Highly<br>Motivated |
|-------|-------------|----------|---------------------|--------------------|---------|---------------------|
| Total | 799/97      | 28/3     | 77/10               | 336/42             | 359/45  | 27/3                |

question regarding how the supervisors would characterise the attitudes of their research scholars : (1) is extremely casual, (2) slightly casual, (3) serious, (4) highly motivated. The response shows that 48% of the supervisors, perhaps representing a similar percentage of the scholars, said that the scholars were serious or highly motivated, and 52% said that they were either extremely casual or slightly casual. There were no big differences between the various institutions, only in the IISc the score went up to 73% in place of 48% elsewhere.

**Table 3.14 : Scholars' Working Style  
(Perception of Supervisors)  
(Number/Percentage)**

|       | Valid Reply | No Reply | Disorganised | Organised | Systematic and<br>Ever in Search<br>of Excellence |
|-------|-------------|----------|--------------|-----------|---------------------------------------------------|
| Total | 789/95      | 38/5     | 225/29       | 499/63    | 65/8                                              |

**3.25** With regard to working style, the response was only in three categories namely : 1 – disorganised, 2 – organised, 3 – systematic and ever in search of excellence. The result shows that only 8% appear in the highest category, and 63% in the next lower category. About 30% of the supervisors said that the scholars were disorganised. Here also all institutions were very similar except that the IISc shows only 19% responses for the disorganised category.

**Table 3.15 : Scholars' Depth of Knowledge  
(Perception of Supervisors)  
(Number/Percentage)**

|       | Valid Reply | No Reply | Very Shallow | Confined to<br>the Subject | Inter-<br>Disciplinary |
|-------|-------------|----------|--------------|----------------------------|------------------------|
| Total | 795/96      | 32/4     | 91/11        | 643/81                     | 61/8                   |

**3.26** The question with regard to the depth of knowledge of the scholars was to be answered in three categories : (1) very shallow, (2) confined to the subject, (3) inter-disciplinary. The responses show that only 8% of the supervisors perceived scholars to have inter-disciplinary competence, and 11% said they were very shallow. More than 80% of the supervisors say scholars' knowledge was confined to the subject. Supervisors from all institutions gave very similar replies.

**3.27** Table 3.16 provides some very interesting information about the whole research set up. Supervisors were asked to rank order three of the most important factors which could be improved upon in their research set up. It is remarkable that "atmosphere" and "motivation" taken together were given the highest rank in the IITs as well as the Central universities. In the State universities, because of their greater financial constraints and consequent

**Table 3.16 : Factors to be Improved upon in the Research Set up  
(Perception of the Supervisors in Percentage)**

| Factor     | CU |    |    | SU |    |    | IIT |    |    |
|------------|----|----|----|----|----|----|-----|----|----|
|            | 1  | 2  | 3  | 1  | 2  | 3  | 1   | 2  | 3  |
| Labortary  | 25 | 18 | 12 | 27 | 25 | 12 | 27  | 18 | 5  |
| Library    | 15 | 14 | 16 | 19 | 22 | 19 | 11  | 11 | 17 |
| Funds      | 15 | 19 | 17 | 27 | 20 | 19 | 18  | 18 | 13 |
| Rules      | 4  | 9  | 9  | 6  | 8  | 11 | 2   | 6  | 5  |
| Red Tape   | 3  | 6  | 7  | 3  | 6  | 7  | 8   | 5  | 8  |
| Linkages   | 1  | 1  | 4  | 2  | 2  | 4  | 2   | 1  | 8  |
| Atmosphere | 11 | 13 | 11 | 8  | 7  | 8  | 7   | 17 | 10 |
| Motivation | 23 | 14 | 16 | 5  | 6  | 15 | 21  | 16 | 14 |

problems with regard to laboratory and library, supervisors were obliged to give 4th place to “atmosphere” and “motivation”. While “motivation” is internal and subjective for each person, the “atmosphere” is an ensemble of many factors which contribute to it, like the general state of facilities and services, human relations, seriousness of purpose and efficiency shown by all involved including the administrators. In fact, this response is a strong justification that “atmosphere” and “motivation” should be investigated from all possible angles.

**3.28** The scholars themselves were asked about the level of dedication to research amongst their fellow workers and the result is available in Table 3.17. Since this is self-perception, the percentages are likely to be on the

**Table 3.17 : Level of Dedication to Research  
(Number/Percentage)**

| Category | Valid Reply | No Reply | Very High | High   | Medium | Low   | Very Low |
|----------|-------------|----------|-----------|--------|--------|-------|----------|
| CU       | 647/97      | 23/3     | 98/15     | 234/36 | 267/41 | 37/6  | 11/2     |
| SU       | 843/97      | 30/3     | 114/14    | 350/42 | 318/38 | 49/6  | 12/1     |
| IIT      | 277/98      | 5/2      | 44/16     | 113/48 | 84/30  | 13/5  | 3/1      |
| IISc     | 234/95      | 13/5     | 40/17     | 118/50 | 66/28  | 9/4   | 1/3      |
| Total    | 2001/97     | 17/3     | 296/14    | 835/39 | 735/36 | 108/5 | 27/1     |

higher side, still “very high” ranges between 14% and 17%. In “high” category of dedication, the Central universities stand at the lowest point of 36% and the Indian Institute of Science at the highest point of 50%. Level of dedication may be high or very high only amongst half of the scholars according to their own perception, but around 80% consider themselves to be successful in their careers as compared to similarly qualified people as shown by Table 3.18.

**Table 3.18 : Comparative Success – Age and Qualification-wise  
(Number/Percentage)**

| Category | Valid Reply | No Reply | Very Successful | Fairly Successful | Unsuccessful |
|----------|-------------|----------|-----------------|-------------------|--------------|
| CU       | 642/96      | 28/4     | 103/16          | 453/71            | 86/13        |
| SU       | 839/96      | 34/4     | 136/16          | 652/78            | 51/6         |
| IIT      | 270/96      | 12/4     | 29/11           | 220/81            | 21/8         |
| IISc     | 232/94      | 15/6     | 36/16           | 183/79            | 13/6         |
| Total    | 1983/96     | 89/4     | 304/15          | 1508/76           | 171/9        |



**3.29** Two questions were designed to assess the understanding of the scientific process by the scholars. First was “In case you came across some observation while engaged in research which did not fit with existing theories or results obtained by others, would you (1) reject the observation, (2) redesign the experiment to verify the observation, (3) review the theory, or (4) believe in your observation and proceed further”. The result is in Table 3.19, which, apart from showing the similarity of response from scholars of various

**Table 3.19 : Action on any Exceptional Observation during Research  
(Number/Percentage)**

| Category | Valid Reply | No Reply | Reject the Observation | Redesign the Experiment to Verify Observation | Review the Theory | Believe in Your Observation and Proceed further |
|----------|-------------|----------|------------------------|-----------------------------------------------|-------------------|-------------------------------------------------|
| CU       | 683/98      | 67/11    | 19/3                   | 334/55                                        | 59/10             | 191/32                                          |
| SU       | 804/92      | 69/8     | 21/3                   | 502/62                                        | 110/14            | 171/21                                          |
| IIT      | 252/89      | 30/11    | 3/1                    | 158/63                                        | 39/15             | 52/21                                           |
| IISc     | 223/90      | 24/18    | 6/3                    | 163/73                                        | 17/8              | 37/7                                            |
| Total    | 1882/91     | 190/9    | 49/3                   | 1157/61                                       | 225/12            | 451/24                                          |

institutions, indicates that nearly 24% would believe the first observation and proceed further. This represents rather uncritical acceptance of an observation which could have been there because of some mistake. Another 12% would review the theory just because of one chance observation. It is good that about 60% would take the right course and redesign the experiment, if necessary, for the purpose of ascertaining the observation. The Indian Institute of Science, being exclusively a research institute, has the best response.

**3.30** Another question was about rating the role of reasoning, reflection, imagination and intuition in scientific research. Each factor was to be judged on its own, there was no judgement of relative importance of the factors. The results are provided in Table 3.20. It is rather surprising that even about reasoning scholars found it possible to divide the role in “significant” and “very important” categories. Reflection was considered to be of little or no

**Table 3.20 : Role of Various Factors with Respect to Research  
(Number/Percentage)**

|             | Valid Reply | No Reply | None   | Very Little | Significant | Very Important |
|-------------|-------------|----------|--------|-------------|-------------|----------------|
| Reasoning   | 1959/95     | 113/5    | 57/3   | 110/6       | 518/26      | 1274/65        |
| Reflection  | 1830/88     | 242/12   | 88/5   | 405/22      | 964/53      | 373/20         |
| Imagination | 1933/93     | 139/7    | 143/7  | 354/18      | 753/39      | 683/35         |
| Intuition   | 1876/91     | 196/9    | 250/13 | 511/27      | 597/32      | 518/28         |

significance in research by 27% of the scholars. Sitting back and taking a dispassionate critical view of the progress of the work and opportunities was thought to be unimportant by such a large number. Imagination fared in the way, but intuition came out the worst, with 40% of the scholars assigning little role to it in the course of their research. These deficiencies in the approach to creative activity are related to the fact that research has come to mean, at best, full involvement in the daily routine of reading about the subject, or taking observations and drawing graphs or calculating the results. Researchers are not exposed to scientific and philosophical discussions about the knowledge that they are engaged in generating. These discussions could not only inform these people better, but also motivate them to engage in the pursuit of their objectives.

**3.31** It was considered very desirable to obtain at least some idea about the creative potential of the scholars. It is known that intelligence and creativity are different in some important respects, and the creative persons show their talent in a variety of ways. Obviously, the questionnaires could not test creativity in any of the established ways. But literature on that subject indicates that a good idea of the creative potential of an individual can be obtained from the record of an individual having engaged in creative activities in the course of his or her life. In a question, which proved quite difficult to analyse, scholars were asked if they were “seriously interested or engaged” in one of the listed activities. Each scholar was allowed three choices, and the activities listed were literary (like composing poetry, or journalism),

**Table 3.21 : Have You Been Seriously Interested/Engaged in the following Activities**

| Activity                                   | Number | Percentage |
|--------------------------------------------|--------|------------|
| (1) Painting/Sketching                     | 456    | 22         |
| (2) Floral Art                             | 128    | 6          |
| (3) Handicrafts                            | 214    | 10         |
| (4) Translation                            | 107    | 5          |
| (5) Study of Plants                        | 394    | 19         |
| (6) Star Gazing                            | 200    | 10         |
| (7) Music/Dance                            | 858    | 41         |
| (8) Embroidery                             | 254    | 12         |
| (9) Composing Poetry                       | 215    | 10         |
| (10) Journalism                            | 177    | 9          |
| (11) Bird Watching                         | 315    | 15         |
| (12) Writing Plays/Stories/Science Fiction | 268    | 13         |
| (13) Making and Repairing                  |        |            |
| Mechanical/Electrical Gadgets              | 319    | 15         |
| No Reply                                   | 457    | 22         |
| Total Reply                                | 4372   | —          |

Note: Respondents 2072, each was allowed maximum of three Choices



innovative in skills employed (like handicrafts), or in the area of fine arts (like painting or music) and observational (like bird watching), etc. The response is tabulated in two ways in Tables 21 and 22. Out of 2072 scholars, 457 or 22% did not mark any item at all and they may be considered to have no interests in these activities, or perhaps have no hobbies, or do nothing for relaxation or pleasure. Table 3.21 shows the number and percentage of those who indicated each single activity. Music and dance are at the top with 41% scholars ticking it, most likely because even without serious interest, a large number of people listen to songs or watch song and dance sequences on T.V. Painting and sketching, marked by 22% scholars, are a significant indicator of creative interest. The literary interests were indicated by 5%(translation), 10%(composing poetry), 9%(journalism), 13%(writing plays, stories, etc). Of course, because of three choices for each individual, one must interpret this cautiously – same persons could have marked some of these alternatives. 15% scholars indicated serious interest in making and repairing mechanical or electrical gadgets.

**3.32** Table 3.22 shows clusters of these activities and distribution of scholars in institutions interested in them. There is considerable uniformity in response, even mechanical or electrical interest does not dominate in the technical institutions, the IITs. Lack of any such interest is, however, highest in the technical institutions and the Indian Institute of Science. Perhaps the more serious one is about research, the narrower is the range of other interests and activities. Unfortunately, there is no other data available from any other study to make a comparison. To some discussants this Table is a pleasant surprise showing greater interest of scholars in such activities than one could gather on account of impressions. These interests often remain hidden from supervisors.

**Table 3.22 : Category-wise Distribution of Hobbies  
(Number/Percentage)**

| Category | Valid Reply | No Reply | Literary | Fine Arts | Mechanical | Observational |
|----------|-------------|----------|----------|-----------|------------|---------------|
| CU       | 670         | 133/20   | 216/32   | 381/57    | 174/26     | 243/36        |
| SU       | 873         | 174/20   | 211/24   | 501/57    | 208/24     | 308/35        |
| IIT      | 282         | 87/31    | 75/27    | 168/60    | 67/24      | 87/31         |
| IISc     | 247         | 63/26    | 62/25    | 134/54    | 54/22      | 62/25         |
| Total    | 2072        | 457/22   | 564/27   | 1184/57   | 503/24     | 700/34        |

Referring to Table 3.21 : Literary Includes (4), (12), (9), (10)  
 Fine Arts Includes (1), (2), (7), (8)  
 Mechanical Includes (3), (13)  
 Observational Includes (5), (6), (11)



## Academic Background of the Supervisors

### General Features

**4.01** In the 829 responses that have been received from supervisors, 827 have been found to be proper and they have been analysed. The breakup of the respondents in terms of men and women and designations in the universities as Professors, Readers or Lecturers is shown in Table 4.01. In

**Table 4.01 : Designation-wise Distribution of Supervisors**

| Category | Total | Lecturer | Reader | Professor | Male | Female |
|----------|-------|----------|--------|-----------|------|--------|
| CU       | 307   | 17       | 135    | 155       | —    | —      |
| SU       | 392   | 21       | 142    | 227       | —    | —      |
| IIT      | 96    | —        | 1      | 95        | —    | —      |
| IISc     | 34    | —        | —      | 34        | —    | —      |
| Total    | 829   | 38       | 278    | 511       | 775  | 52     |

the same Table, the distribution of these responses with regard to institutional affiliation is also shown. It has already been stated that the two most prestigious awards in the country, namely, the Bhatnagar Award and the Hari Om Award, have been won by 125 and 9 of the respondents, respectively. Other distinctions like Fellowships of the Academies, such as the Indian National Science Academy, have been reported by 162 respondents. They have vast experience of guiding research, and examining Ph.D. theses. This wealth of experience is represented in Tables 4.02(a) and 4.02(b) which present the information in some detail. Table 4.02(b) has been derived from Table 4.02(a).

### Number of Scholars per Supervisor

**4.02** The opinion has been quite strong in India that ordinarily a supervisor should not have more than four scholars registered for the Ph.D. degree under

**Table 4.02(a) : Number of Scholars under Supervisors  
(Supervisors' Response)**

| Category | Scholars Supervised<br>So Far | Scholars Working<br>at Present | Ph.D. Theses<br>Examined<br>by Supervisors |
|----------|-------------------------------|--------------------------------|--------------------------------------------|
| CU       | 2478                          | 987                            | 2646                                       |
| SU       | 3602                          | 1423                           | 4030                                       |
| IIT      | 1076                          | 252                            | 1660                                       |
| IISc     | 561                           | 133                            | 645                                        |
| Total    | 7717                          | 2795                           | 8981                                       |

**Table 4.02(b) : Number of Scholars/Theses  
(Per Supervisor)**

| Category | Number of<br>Supervisors | Scholars<br>at Present | Scholars Supervised<br>So Far | Theses Examined<br>So Far |
|----------|--------------------------|------------------------|-------------------------------|---------------------------|
| CU       | 307                      | 3.2                    | 8                             | 8.6                       |
| SU       | 392                      | 3.6                    | 9.2                           | 10.2                      |
| IIT      | 96                       | 2.6                    | 11.2                          | 17.3                      |
| IISc     | 34                       | 3.9                    | 16.5                          | 18.9                      |
| Total    | 829                      | 3.4                    | 9.3                           | 10.8                      |

him or her. This is because, again, ordinarily, one or two scholars are supposed to be reaching the end of their work, while the other two are at an earlier stage, and hence the supervisor has really at any one time to attend to two or three scholars only. Since some of the supervisors' time is given to teaching or to looking after a laboratory, it has been felt that justice cannot be done to more than four scholars at a time. However, the present situation is represented by Table 4.03(a) where the responses of scholars tell us as to how many students their supervisors are guiding. This Table shows that about 38% of the supervisors might have 5,6,7 or even more scholars. Only

**Table 4.03(a) : Number of Scholars with Supervisors  
(Responses of Scholars)  
(Number/Percentage)**

| Category | 1-2    | 3-4    | 5-6    | Above 7 |
|----------|--------|--------|--------|---------|
| CU       | 177/26 | 217/32 | 157/23 | 119/18  |
| SU       | 289/33 | 237/27 | 206/24 | 141/16  |
| IIT      | 122/43 | 91/32  | 40/14  | 29/10   |
| IISc     | 58/23  | 77/31  | 81/33  | 31/13   |
| Total    | 646/31 | 622/30 | 484/23 | 320/15  |

61% have four scholars or less. The Table also tells us that all the institutions are in approximately the same position, with the IITs being on the side of conforming to the guidelines of four scholars, and the IISc being the farthest away from it, with a larger number of supervisors having a large number of scholars.

**Table 4.03(b) : Supervisors' Number with Respect to the Number of Scholars under Them**  
(Supervisors' Response)  
(Number/Percentage)

| Category | Valid Data | 1 – 2  | 3 – 4  | 5 – 6  | More Than 7 |
|----------|------------|--------|--------|--------|-------------|
| CU       | 276        | 99/36  | 102/37 | 56/26  | 19/7        |
| SU       | 366        | 115/31 | 135/37 | 75/20  | 41/11       |
| IIT      | 84         | 42/50  | 27/32  | 9/11   | 6/7         |
| IISc     | 32         | 7/22   | 10/31  | 12/38  | 3/9         |
| Total    | 758        | 263/35 | 274/36 | 152/20 | 69/9        |

**4.03** A similar question was asked to the supervisors, the response of which is tabulated in Table 4.03(b). A comparison of Tables 4.03(a) and 4.03(b) leads us to some interesting disparities of the two responses. 61% scholars say that their supervisors have 1 to 4 scholars working with their guides, whereas 71% supervisors claim a similar number. On the other hand, while 38% scholars declare their supervisors having 5 to 7 or even more scholars, only 29% supervisors accept these figures. Similar variations of responses are seen even if one goes by the category of institutions. This may partly be due to the fact that responding scholars may not belong to the responding supervisors, and perhaps also because supervisors with large number of scholars have underplayed this figure.

### **Mobility of the Faculty**

**4.04** It is of interest to study the mobility of the supervisors from one institution to another at various points in the upward ladder, starting from M.Sc. via Ph D. and then selection to the posts of Lecturer, Reader and Professor. The university appointments in India are supposed to be by selection at each stage, and every time the competition is supposed to be countrywide. Therefore mobility in a sense represents selection by merit and for this reason it has been considered very desirable. Of course, too much mobility is neither feasible nor in the best interests of research, because schools of research, have to survive on the basis of continuity of leadership.



**4.05** The responses of the supervisors allowed an analysis of mobility to be made and it is represented in Table 4.04. In this Table, the data for

**Table 4.04 : Mobility of Supervisors  
(Number/Percentage)**

| Level                                 | Response<br>(Number/Percentage) |
|---------------------------------------|---------------------------------|
| <b>Reader (Total Response 278)</b>    |                                 |
| No Mobility at any Point              | 139/50                          |
| Total Mobility                        | 20/7                            |
| M.Sc. to Ph.D. Mobility               | 106/38                          |
| Ph.D. to Lecturer Mobility            | 95/34                           |
| Lecturer to Reader Mobility           | 35/13                           |
| <b>Professor (Total Response 511)</b> |                                 |
| No Mobility at any Point              | 139/27                          |
| Total Mobility                        | 20/4                            |
| M.Sc. to Ph.D. Mobility               | 267/52                          |
| Ph.D. to Lecturer Mobility            | 194/38                          |
| Lecturer to Reader Mobility           | 102/20                          |
| Reader to Professor Mobility          | 51/10                           |

Readers and Professors is shown separately and it may be noted that for the Readers there are three transitions, which are from M.Sc. to Ph.D., Ph.D. to Lecturer, and Lecturer to Reader. Similarly, in the case of Professors there are four transitions. The data shows that 50% of the Readers have no or zero mobility, and 27% of the Professors have zero mobility, that is, they have gone through from M.Sc. to their final position without change of institution. This is a high degree of adherence to one institution, and it is perhaps, one reason for strong traditionalism in the universities. In practical terms, it also represents entrenched interests being established in the departments of the universities, the "seniors" or perpetuals dominating the faculty. On the other hand, only 7% of the Readers and 4% of the Professors have been mobile at every step.

**4.06** It is seen that the single step mobility from M.Sc. to Ph.D. is 38% for Readers and 52% for Professors. Since the transitions from M.Sc. to Ph.D. in the case of Professors must have taken place 5 to 10 years earlier than in the case of Readers, this data shows that there was greater mobility in earlier years than in later years. The mobility from Ph.D. to Lecturer also confirms the same feature and, it is the same from Lecturer to Reader. The data clearly shows a reduction in mobility of the staff in the course of time.

**4.07** Stated in other words, the data implies that 90% of the Readers became Professors in the same university, and 80 to 90% Lecturers became Readers in the same university. A high degree of attachment to the same university prevails. Whereas the selections at each stage are intended to be open to candidates from the whole country, they are in practice largely confined to the same university. Each university seems to be selecting its own people for the next higher post and claiming that they were the best candidates!

### Role of Thought Processes in Research

**4.08** The question of the role of various intellectual processes by which research is done was put to the supervisors also, as it was put to the scholars (see Table 3.20). The data is provided in Table 4.05.

**Table 4.05 : Supervisors' Perception about the Role of Various Intellectual Factors  
(Number/Percentage)**

| Factors     | Valid Reply | No Reply | None  | Very Little | Significant | Very Important |
|-------------|-------------|----------|-------|-------------|-------------|----------------|
| Reasoning   | 804/97      | 23/3     | 14/2  | 47/6        | 194/24      | 549/68         |
| Reflection  | 758/92      | 69/8     | 33/4  | 165/22      | 404/53      | 156/21         |
| Imagination | 796/96      | 31/4     | 26/3  | 109/14      | 304/38      | 357/45         |
| Intuition   | 788/95      | 39/5     | 82/10 | 189/24      | 293/37      | 224/28         |

**4.09** On the role of reasoning, 8% of the supervisors say that it has no role or very little, but only 68% rated it as very important. We do not find much of a difference in the response of the supervisors from various sets of institutions and, therefore, this is how the academics seem to rate the role of reasoning.

**4.10** In the case of the role of reflection in scientific research, it is found that 26% of the supervisors perceive very little role for it. The Central and the State universities are very similar in their response but the IITs and the IISc supervisors give it a little more importance.

**4.11** On the role of imagination, it is again found that a fairly steady, 17% supervisors underrate it, while only 45% have ranked it as very important. Here again the universities seem to be in the same position together, although the State universities represented by the supervisors underrate imagination a little more than the Central universities. The IITs and the IISc give it much more importance than the universities.



**4.12** Institution is ranked to be very low in its role in scientific research by as many as 35% of the supervisors and only 28% say that it is very important. Once again the supervisors in the IITs are more in favour of the importance of intuition.

**4.13** These responses may be compared with those of the scholars and they seem to be quite similar. Perhaps, these responses represent the common ethos of the intellectual community. It is, however, clear from the study of the institutional practices that questions of creative process, approach and methodology are hardly ever discussed at the philosophical level among the community of scholars and supervisors. Most of the time they are occupied only with the work in their special fields of study, and reasoning is the main tool.

### Scholars' Perception about Supervisors

**4.14** Just like the perception of supervisors about their scholars was obtained, a study of what the scholars think about their supervisors was also undertaken. Such a study is indicative of the kind of mutual regard which prevails in the partnership of scholars and supervisors and reflects on the total atmosphere of research. The data is shown in Table 4.06.

**Table 4.06 : Perception of Scholars about Their Supervisors  
(Number/Percentage)**

|                                                          | CU     |        | SU     |        | IIT    |        | IISc   |        | Total   |         |
|----------------------------------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|---------|---------|
|                                                          | Yes    | No     | Yes    | No     | Yes    | No     | Yes    | No     | Yes     | No      |
| Upto-date in Knowledge                                   | 463/69 | 207/31 | 606/69 | 267/31 | 158/46 | 124/43 | 139/56 | 108/43 | 1366/66 | 706/34  |
| Well Connected with Other Specialists/Institutions       | 430/64 | 240/36 | 582/67 | 291/33 | 161/57 | 121/43 | 127/51 | 120/48 | 1300/63 | 772/37  |
| Associated with Industry/Agriculture                     | 105/16 | 565/84 | 157/18 | 716/82 | 45/16  | 237/84 | 42/17  | 205/82 | 349/17  | 1723/83 |
| Devotes Enough Time for Research Scholars                | 462/69 | 208/39 | 594/68 | 279/32 | 173/61 | 109/39 | 150/60 | 97/39  | 1379/66 | 693/33  |
| Actually Participates in Research Activity of Scholar    | 388/58 | 282/42 | 511/59 | 362/41 | 137/49 | 145/51 | 122/49 | 125/50 | 1158/56 | 914/44  |
| Checks the Data/Experimental Readings                    | 458/68 | 212/32 | 590/68 | 283/32 | 163/58 | 119/42 | 145/58 | 102/41 | 1356/65 | 716/35  |
| Gives Generous Credit to the Scholars for Original Ideas | 409/61 | 261/39 | 563/64 | 310/36 | 159/56 | 123/44 | 154/62 | 93/37  | 1285/62 | 787/38  |
| Skilful in Public Dealings                               | 410/61 | 260/39 | 525/60 | 348/40 | 158/56 | 124/44 | 129/52 | 118/47 | 1222/56 | 850/41  |
| Man of Ideas                                             | 412/61 | 258/39 | 569/65 | 304/35 | 153/54 | 129/46 | 133/53 | 114/46 | 1267/61 | 805/39  |

**4.15** A general look at the column giving the totals indicates that one third of the scholars feel that their supervisors are not up-to-date in knowledge, not very well connected with other institutions or specialists, do not devote enough time to research, do not check data or experimental readings, and



do not give generous credit to the scholars for their original ideas. They are not even perceived to be men of ideas by the scholars. It is notable that more than 80% of the supervisors are not in touch with industry or agriculture or other aspects of application of their branch of science. These are very high percentages of a negative kind. But it is surprising that the IISc scholars in larger percentages attribute negative features with their supervisors. The defence can be that the scholars have higher expectations at the IISc, but then the perception of their scholars should be a matter of concern for the research activity at that institute. The scholars of the IITs, too, are in a way more negative than those of the Central and the State universities.

**4.16** The fact that a large number of scholars, almost 50%, say that the supervisors do not actually participate in the research activity of scholars, and such a large number, as 35% to 42%, say that the supervisors do not check the data or experimental readings is also a matter of concern, and it could be related to a later Table that will be presented about the possibility of malpractices in the course of research. On the question of giving generous credit to the scholars for their ideas, the percentage of negative response ranges between 36% and 44%, and this negative feature contributes to the lack of mutual confidence between scholars and supervisors, thus it is an unhealthy feature.

### Quality of Research Guidance as A Whole

**4.17** Table 4.07 is a response of the scholars to a question about the quality of research guidance in the various institutions. Only 9% of the scholars perceive research guidance to be "very poor" or "poor". On the other hand,

**Table 4.07 : Scholars' Perceptions about Research Guidance**  
(Number/Percentages)

| Category | Valid Reply | No Reply | Very Poor | Poor  | Fair   | Good   | Excellent |
|----------|-------------|----------|-----------|-------|--------|--------|-----------|
| CU       | 655/98      | 15/2     | 22/3      | 37/6  | 144/22 | 273/42 | 180/27    |
| SU       | 857/98      | 16/2     | 22/3      | 39/5  | 129/15 | 338/39 | 329/38    |
| IIT      | 273/97      | 9/3      | 17/6      | 23/8  | 72/26  | 105/38 | 56/21     |
| IISc     | 239/97      | 8/3      | 11/5      | 11/5  | 41/17  | 107/45 | 69/29     |
| Total    | 2024/98     | 48/2     | 72/4      | 110/5 | 368/19 | 823/41 | 634/31    |

only 72% perceive it to be either "good" or "excellent". "Fair", in this context, probably means just about tolerable, and it cannot be taken as a positive opinion. So about 25% to 30% of the scholars perceive inadequacies in guidance. It is a bit of a difficult proposition to explain that whereas 72% scholars find research guidance to be "good" or "excellent", when the guidance is broken up into its various components, as is found in Table 4.06, the complimentary opinion is much diluted, that is, it goes down to 60% and 65%. It can be argued that the two results are very dissimilar, but one may also argue that the opinion in parts, being explicit, has its own value, whereas the opinion as a whole represents a more amorphous perception. Table 4.06 provided opinion of specific aspects of guidance, whereas Table 4.07 is an overall view.

## CHAPTER V

# The Processes of Research

### Time Spent on Research

**5.01** It is important to study the whole process of research in order to examine its state of health. Starting with the simplest, Table 5.01 is a set

**Table 5.01 : Scholars Spending more than Eight Hours per Day on Research  
(Number/Percentage)**

| Category | Valid Reply | No Reply | None  | Few    | Most   | All    |
|----------|-------------|----------|-------|--------|--------|--------|
| Total    | 805/97      | 22/3     | 83/10 | 196/24 | 336/41 | 190/24 |

of responses obtained from supervisors regarding how many of their research scholars spend more than eight hours per day on research. This question was studied because one often hears a complaint that lot of scholars are absent a lot of time from their laboratories or places of work. The responses indicate that, in general, about 65% of the supervisors say that either "most" or "all" of their scholars spend more than eight hours per day on research. It is again found that all the institutions are practically in the same position, except the IISc where the percentages of supervisors reporting on the low side is smaller than the average, and on the high side is higher than the average.

**5.02** Table 5.02 is based on a companion question about how many of the scholars spend more than 250 days in a year on research. 79% of the supervisors on the whole say that "most" or "all" do, while 20% say that "none" or "only a few" spend more than 250 days in a year on their research.

**Table 5.02 : Scholars Spending more than 250 Days in a Year on Research  
(Number/Percentage)**

| Category | Valid Reply | No Reply | None | Few    | Most   | All    |
|----------|-------------|----------|------|--------|--------|--------|
| Total    | 805/97      | 22/3     | 44/5 | 122/15 | 315/39 | 324/40 |



Institutional data is typically similar, but only at the IISc the performance is better at both ends of the spectrum.

## Supervision and Guidance

**5.03** Another question pertained to the frequency of meetings between the scholars and supervisors in order to keep track of the work and to instruct or help the scholars to move on in their research. The response in Table 5.03 shows that 33% of the supervisors hold such meetings “once a week”, 9%

**Table 5.03 : Discussion Meetings of Supervisors with their Research Scholars**  
(Number/Percentage)

| Category | Valid Reply | No Reply | Once a Week | Once a Fortnight | Once a Month | As and When |
|----------|-------------|----------|-------------|------------------|--------------|-------------|
| CU       | 292         | 15/4     | 92/32       | 23/8             | 5/2          | 172/59      |
| SU       | 387         | 6/2      | 114/29      | 42/11            | 11/3         | 220/57      |
| IIT      | 92          | 2/2      | 46/50       | 4/4              | 1/1          | 41/45       |
| IISc     | 33          | 1/2      | 16/48       | 1/3              | —            | 16/48       |
| Total    | 804         | 24/3     | 268/33      | 70/9             | 17/2         | 449/56      |

“once in a fortnight”, and 2% “once a month”. 56% of the supervisors report that they have discussions with their research scholars only “as and when” (necessary). Since the frequency was given as a set of alternatives, the option “as and when” was only an euphemism for being casual about this very serious responsibility which the supervisors have to discharge. Since once a week is ordinarily considered to be a more desirable way of carrying on an interaction between the supervisors and the scholars, one finds that only in the IITs and the IISc the percentage of supervisors meeting scholars, once a week, is around 50%. But then even in the IITs and the IISc, the casual meeting is indicated to be as high as 45% and 48%, respectively.

**5.04** Yet another very common way of helping the scholars with their work is to provide them an opportunity at suitable intervals, to communicate the progress of their work to other researchers in seminars. The criticism and a sort of brainstorming about the future course of action are both useful. It is a proud occasion for a scholar to stand up and make a presentation before his peers. Therefore, a question was directed to the supervisors on whether it was a regular practice in their departments to have the scholars present their research, at least once a year, for a discussion at a departmental seminar. The response tabulated in Table 5.04 indicates that about 71% of the supervisors give a negative reply and only in 29% cases is this a regular

practice. Here one finds the IITs and the IISc again, to be in a better position because about 65% of the supervisors say that such an opportunity is given to the scholars in their departments.

**Table 5.04 : Regular Practice of Discussion at a Departmental Seminar  
(Number/Percentage)**

| Category | Valid Reply | No Reply | Yes    | No     |
|----------|-------------|----------|--------|--------|
| CU       | 303         | 4/1      | 58/19  | 245/81 |
| SU       | 337         | 56/14    | 80/24  | 257/76 |
| IIT      | 94          | —        | 59/63  | 35/37  |
| IISc     | 34          | —        | 22/65  | 12/35  |
| Total    | 768         | 60/7     | 219/29 | 549/71 |

**5.05** The same kind of question regarding regular presentation of research work, atleast annually, for a discussion at the departmental seminars was directed to the scholars. In this case, 60% of the scholars said that there was no practice of regular presentation in the system as a whole. The IITs and the IISc show a better situation than the Central and State universities. The slight variation that one notices between Tables 5.04 and 5.05 may be because

**Table 5.05 : Regular Presentation of Research Work in a Departmental Seminar Atleast Annually  
(Number/Percentage)**

| Category | Yes    | No      |
|----------|--------|---------|
| CU       | 152/23 | 518/77  |
| SU       | 328/38 | 545/62  |
| IIT      | 163/58 | 119/42  |
| IISc     | 190/77 | 57/23   |
| Total    | 833/40 | 1239/60 |

the distribution of scholars in the institutions is different from the distribution of supervisors who have responded, but there is no disagreement that the situation in this regard is unsatisfactory.

**5.06.** In order to obtain yet another confirmation, if possible, of these results, another question was directed to the supervisors in the form : “in order to get the best results, should the supervision be generally (1) more strict; (2) more liberal; (3) more systematic and (4) less structured.” The responses in Table 5.06 clearly indicate that 69% of the supervisors would like the supervision to be more systematic than what it is. Only 8% wanted it to be more liberal and another 8% wanted it to be less structured. 15% of the supervisors have chosen the word “more structured” instead of “more

**Table 5.06 : Type of Supervision  
(Number/Percentage)**

| Category | Valid Reply | No Reply | More Strict | More Liberal | More-Systematic | Less Structured |
|----------|-------------|----------|-------------|--------------|-----------------|-----------------|
| Total    | 764/92      | 63/8     | 114/15      | 62/8         | 525/69          | 63/8            |

systematic”, but their thinking is in the same direction. This means that 84% of the supervisors perceive that supervision has to be “more strict” or “more systematic”, and hence there is hope that, being conscious of the deficiencies in this respect, they are keen about rectification in the process of supervision.

**5.07** There was the need to obtain from the scholars, who are at the receiving end, some idea of their perception about the nature of the supervision and administration of the departments in which they work. Responses to the question are shown in Table 5.07. The Table indicates that as many as 23%

**Table 5.07 : Administration and Environment of the Departments  
(Number/Percentage)**

| Category | Valid Reply | No Reply | Autocratic | Democratic | Fair Minded |
|----------|-------------|----------|------------|------------|-------------|
| CU       | 626/93      | 44/7     | 170/27     | 220/35     | 236/38      |
| SU       | 797/91      | 76/9     | 171/21     | 299/38     | 327/41      |
| IIT      | 254/90      | 28/10    | 64/25      | 70/28      | 120/47      |
| IISc     | 224/91      | 23/9     | 28/13      | 72/32      | 124/55      |
| Total    | 1901/92     | 171/8    | 433/23     | 661/35     | 807/42      |

of the scholars found their departments to be “autocratic”, with the IISc coming at the lowest point with 13%. 35% of the scholars were able to certify their departments as “democratic”, and 43% chose to call their departments “fair minded”.

**5.08** Another question was asked to the scholars on a somewhat related parameter about the administrative climate of the departments. Here in Table 5.08, 39% of the scholars found the departments to have either “frustrating”

**Table 5.08 : Research Environment of the Departments  
(Number/Percentage)**

| Category | Valid Reply | No Reply | Encouraging | Frustrating | Callous |
|----------|-------------|----------|-------------|-------------|---------|
| CU       | 613/91      | 57/9     | 332/54      | 220/36      | 61/10   |
| SU       | 799/90      | 74/8     | 511/64      | 238/30      | 50/6    |
| IIT      | 252/89      | 30/11    | 140/56      | 79/31       | 33/13   |
| IISc     | 216/87      | 31/13    | 169/78      | 27/13       | 20/9    |
| Total    | 1880/91     | 192/9    | 1152/61     | 564/30      | 164/9   |



or “callous” environment or atmosphere. The largest percentage saying that the environment was “encouraging” is found in the IISc (78%) and in the state universities (64%). The largest response of the environment being callous came from the IITs.

**5.09** The interesting point to study is whether any of the departments which are said to be “encouraging” in their atmosphere are “autocratic”, or conversely, are any of the departments said to have a “democratic” or “fair minded” supervision and administration, “frustrating” or “callous” with regard to their “atmosphere”? This point has been brought out by Table 5.09 which counterposes the manner of running the department with the

**Table 5.09 : Perception of Scholars about Running of Research Units/Departments  
(Number/Percentage)**

|             | Valid Data | Encouraging | Frustrating | Callous |
|-------------|------------|-------------|-------------|---------|
| Autocratic  | 414        | 101/24      | 259/63      | 54/13   |
| Democratic  | 632        | 424/67      | 171/27      | 37/6    |
| Fair Minded | 763        | 580/76      | 112/15      | 71/9    |

general atmosphere which is perceived. As expected, autocratically run departments lead to a frustrating atmosphere and a feeling that the system is unresponsive to humane considerations, to the extent of 76% of response. But in 24% cases autocratic departments do also create an encouraging atmosphere. There must be benevolent autocracy in existence! Similarly departments run democratically or fair-mindedly can still have a negative subjective feeling among scholars to the extent of 33% and 24% respectively. The best figures are, of course, for democratic and fair-minded administrations creating a favourable, encouraging atmosphere.

**5.10** The question of atmosphere was investigated in another manner from the response of the scholars, correlating perception on whether research guidance was good or excellent and perception regarding administration being autocratic/democratic/fair-minded. This is represented in Table 5.10. Among the good supervision cases, 23% belonged to autocratically run departments.

**Table 5.10 : Quality of Guidance/Running of Research Unit  
(Number/Percentage)**

| Quality of Guidance | Valid Data | Autocratic | Democratic | Fair Minded |
|---------------------|------------|------------|------------|-------------|
| Good                | 631        | 142/23     | 142/23     | 347/55      |
| Excellent           | 585        | 76/13      | 222/38     | 287/49      |

Even when supervision was perceived to be excellent, in 13% cases the running of research unit was considered to be autocratic. This confirms the finding in the preceding paragraph. Fair-minded departments evidently show the best results.

## Facilities and Services

**5.11** The processes of research are affected by the quality of various facilities and services available to the scholars and supervisors. A number of questions were directed to the scholars about library facilities, documentation, equipment, computer facilities, maintenance, purchase of consumables, management and coordination of facilities, laboratory assistance services, and team work and cooperation. The response of the scholars on these points is given in Tables 5.11 (a, b, c, d, e, f, g, h, i & j).

**5.12** With regard to library facilities the worst situation seems to prevail in the State universities because of paucity of funds, since 37% of the scholars

**Table 5.11(a) : Library Facilities**  
(Number/Percentage)

| Category | Valid Reply | No Reply | Very Poor | Poor   | Fair   | Good   | Excellent |
|----------|-------------|----------|-----------|--------|--------|--------|-----------|
| CU       | 658/98      | 12/2     | 47/7      | 102/16 | 186/28 | 257/39 | 66/10     |
| SU       | 856/98      | 17/2     | 130/15    | 190/22 | 308/36 | 196/23 | 32/4      |
| IIT      | 275/97      | 7/3      | 12/4      | 27/10  | 59/21  | 136/49 | 41/15     |
| IISc     | 237/96      | 10/4     | 13/5      | 11/5   | 55/23  | 112/47 | 46/19     |
| Total    | 2026/98     | 46/2     | 202/10    | 330/16 | 608/30 | 701/35 | 185/9     |

call these facilities either poor or very poor. It is again a matter of concern that even in an institution as prestigious as the IISc, the library facilities are said to be either "good" or "excellent" by not more than 66% of their own scholars. The IITs are about as well off as the IISc.

**5.13** Table 5.11(b) relates to documentation facilities and here 40% of the scholars of the Central universities and 52% of the State universities say that

**Table 5.11(b) : Documentation**  
(Number/Percentage)

| Category | Valid Reply | No Reply | Very Poor | Poor   | Fair   | Good   | Excellent |
|----------|-------------|----------|-----------|--------|--------|--------|-----------|
| CU       | 617/92      | 53/8     | 102/17    | 142/23 | 202/33 | 149/24 | 22/4      |
| SU       | 793/91      | 80/9     | 187/24    | 224/28 | 274/35 | 95/12  | 13/2      |
| IIT      | 257/91      | 25/9     | 17/7      | 48/19  | 97/38  | 77/30  | 18/7      |
| IISc     | 211/85      | 36/15    | 8/4       | 25/12  | 70/33  | 90/43  | 18/9      |
| Total    | 1878/91     | 194/9    | 314/17    | 439/23 | 643/34 | 411/22 | 71/4      |



the facilities are poor or very poor. Even in the IITs, 26% of the scholars call them poor or very poor. The highest percentage for good and excellent is 52% at the IISc. Documentation is, therefore, even weaker in the system than the library facilities.

**5.14** Table 5.11(c) gives the position with regard to equipment. The State universities, once again, because of constraints on resources, are in the poorest

**Table 5.11(c) : Equipment  
(Number/Percentage)**

| Category | Valid Reply | No Reply | Very Poor | Poor   | Fair   | Good   | Excellent |
|----------|-------------|----------|-----------|--------|--------|--------|-----------|
| CU       | 653/97      | 17/3     | 75/11     | 100/15 | 247/37 | 209/32 | 28/4      |
| SU       | 839/96      | 34/4     | 97/12     | 205/24 | 285/34 | 194/23 | 58/7      |
| IIT      | 260/92      | 22/8     | 12/5      | 35/13  | 104/40 | 92/35  | 17/6      |
| IISc     | 236/96      | 11/4     | 5/2       | 14/6   | 63/27  | 110/47 | 44/19     |
| Total    | 1988/96     | 84/4     | 189/10    | 354/18 | 693/35 | 605/30 | 147/7     |

position. 36% of their scholars say that equipment-wise the situation is "poor" or "very poor". Even in the Central universities, and the IITs, it is no consolation to find 26% and 18% of the scholars finding the major laboratory facility of equipment to be "poor" or "very poor". Hardly a few percent of the scholars in all institutions taken together, say that the position with regard to equipment is "excellent". This is a crucial factor to constrain the type and quality of work which can be done in the institutions. With scanty equipment, often out of date with regard to range and precision, we almost ensure that our brains do not produce the results which others do.

**Table 5.11(d) : Computer Facility  
(Number/Percentage)**

| Category | Valid Reply | No Reply | Very Poor | Poor   | Fair   | Good   | Excellent |
|----------|-------------|----------|-----------|--------|--------|--------|-----------|
| CU       | 611/91      | 59/9     | 240/39    | 94/15  | 130/21 | 106/17 | 41/7      |
| SU       | 757/87      | 116/13   | 371/49    | 81/11  | 115/15 | 128/17 | 62/8      |
| IIT      | 262/93      | 20/7     | 9/3       | 16/6   | 61/23  | 108/41 | 68/26     |
| IISc     | 219/89      | 28/11    | 11/5      | 10/4   | 52/24  | 86/39  | 60/27     |
| Total    | 1849/89     | 223/11   | 631/34    | 201/11 | 358/19 | 428/23 | 231/12    |

**5.15** Table 5.11(d) is about computer facilities. The impression one gets from this Table is of extreme inadequacy of such facilities, on the whole, 45% of the scholars finding them to be "poor" or "very poor". In the State universities, 60% find the facility to be "poor", and in the Central universities,



54%. Even in the IITs and the IISc, in the perception of only 27% of their scholars, computer facilities are "excellent". A great deal of input is required here if the position of all the institutions is to reach even the "fair level".

**5.16** Table 5.11(e) relates to the maintenance of equipment and 42% of the scholars find this to be in a very poor or poor state. Even in the IISc, 24% scholars say that maintenance is "poor". Those who say it is good or

**Table 5.11(e) : Maintenance  
(Number/Percentage)**

| Category | Valid Reply | No Reply | Very Poor | Poor   | Fair   | Good   | Excellent |
|----------|-------------|----------|-----------|--------|--------|--------|-----------|
| CU       | 656/98      | 14/2     | 118/18    | 180/27 | 223/34 | 119/18 | 16/2      |
| SU       | 846/97      | 27/3     | 162/19    | 224/26 | 255/30 | 160/19 | 45/5      |
| IIT      | 268/95      | 14/5     | 48/18     | 58/22  | 115/43 | 42/16  | 5/2       |
| IISc     | 234/95      | 13/5     | 14/6      | 40/18  | 100/43 | 58/25  | 22/9      |
| Total    | 2004/97     | 68/3     | 342/17    | 502/25 | 693/35 | 379/19 | 88/4      |

excellent are in a minority of 23%. Perhaps, paucity of maintenance staff, or its technical competence, or poor management and lack of funds are responsible for this situation. Remedies must indeed be found urgently because the equipment position is bad and it is made worse by poor servicing and supply of spares.

**5.17** Another support service of the system is purchase of consumable items. In this regard Table 5.11(f) gives us the general position and 26% of the

**Table 5.11(f) : Purchase of Consumable Items  
(Number/Percentage)**

| Category | Valid Reply | No Reply | Very Poor | Poor   | Fair   | Good   | Excellent |
|----------|-------------|----------|-----------|--------|--------|--------|-----------|
| CU       | 646/96      | 24/4     | 62/10     | 123/19 | 252/39 | 182/28 | 27/4      |
| SU       | 830/95      | 43/5     | 87/10     | 179/22 | 321/39 | 200/24 | 43/5      |
| IIT      | 264/94      | 18/6     | 10/4      | 42/16  | 104/39 | 96/36  | 12/5      |
| IISc     | 229/93      | 18/7     | 5/2       | 15/7   | 68/30  | 102/45 | 39/17     |
| Total    | 1969/95     | 103/5    | 164/8     | 359/18 | 745/38 | 580/29 | 129/6     |

scholars find the state of this service to be "poor" or "very poor". The State and the Central universities are in the same boat, because this is related not so much to the availability of money as to the organisation of an activity.

**5.18** The management and coordination of facilities has something to do with the administration of the departments and on this specific question whose responses are shown in Table 5.11(g), 37% of the scholars find the situation either "poor" or "very poor". All the institutions, except the IISc, are in

**Table 5.11(g) : Management and Coordination of Facilities  
(Number/Percentage)**

| Category | Valid Reply | No Reply | Very Poor | Poor   | Fair   | Good   | Excellent |
|----------|-------------|----------|-----------|--------|--------|--------|-----------|
| CU       | 648/97      | 22/3     | 105/16    | 170/26 | 230/37 | 112/17 | 23/4      |
| SU       | 835/96      | 38/4     | 117/14    | 216/26 | 265/32 | 192/23 | 45/5      |
| IIT      | 263/93      | 19/7     | 29/11     | 68/26  | 95/36  | 61/23  | 10/4      |
| IISc     | 235/95      | 12/5     | 10/4      | 32/14  | 97/41  | 72/31  | 24/10     |
| Total    | 1981/96     | 91/4     | 261/13    | 486/24 | 687/35 | 437/22 | 102/5     |

a similar position with more than 40% scholars calling this service to be “poor” or “very poor”. Those who find the management and coordination to be “good” or “excellent” are just about one quarter of all the research scholars who have responded.

**5.19** Technical support services in the form of laboratory assistance are also in a miserable state, as many as 47% of the scholars calling them “poor” or “very poor”. In fact, the score is more than 50% for all the institutions, except for the IISc. Even in the IISc, only 13% scholars find the service to be “excellent” and 28% find it to be good enough.

**Table 5.11(h) : Laboratory Assistance Service  
(Number/Percentage)**

| Category | Valid Reply | No Reply | Very Poor | Poor   | Fair   | Good   | Excellent |
|----------|-------------|----------|-----------|--------|--------|--------|-----------|
| CU       | 635/95      | 35/5     | 159/25    | 182/29 | 166/26 | 108/17 | 20/3      |
| SU       | 810/93      | 63/7     | 212/26    | 202/25 | 207/26 | 156/19 | 33/4      |
| IIT      | 254/90      | 28/10    | 41/16     | 61/24  | 99/39  | 40/15  | 13/5      |
| IISc     | 224/91      | 23/9     | 19/8      | 42/19  | 71/32  | 63/28  | 29/13     |
| Total    | 1923/93     | 149/7    | 431/22    | 487/25 | 543/28 | 367/19 | 95/5      |

**5.20** Another question to elicit the perception of scholars was regarding the quality of cooperation and team work, responses to this are shown in Table 5.11(i). Obviously, this question is related to the spirit that prevails,

**Table 5.11(i) : General Teamwork and Cooperation  
(Number/Percentage)**

| Category | Valid Reply | No Reply | Very Poor | Poor   | Fair   | Good   | Excellent |
|----------|-------------|----------|-----------|--------|--------|--------|-----------|
| CU       | 651/97      | 19/3     | 56/9      | 75/12  | 168/26 | 226/35 | 126/19    |
| SU       | 850/97      | 23/3     | 66/8      | 89/10  | 202/4  | 324/38 | 169/20    |
| IIT      | 271/96      | 11/4     | 25/9      | 40/15  | 78/29  | 90/33  | 38/14     |
| IISc     | 239/97      | 8/3      | 16/7      | 23/10  | 67/28  | 89/37  | 44/18     |
| Total    | 2011/97     | 61/3     | 114/6     | 227/11 | 515/26 | 729/36 | 377/19    |



apart from the administration's ability to serve the needs of the research system. It relates to inter-scholar relations, inter-supervisor relations and relations between the research scholars and the service units, like the workshop or the general stores etc. It is a very important aspect of research activity. With good human relations and prevalence of a spirit of cooperation, even with existing deficiencies, work can be expedited. The Table shows that in 17% cases the scholars find it to be "poor" or "very poor", but the Central universities and the IITs come out in a poorer light. Only in about 55% cases is the teamwork and cooperation worthy of being called "good" or "excellent" by the research scholars. There is hardly any other difference among the sets of institutions.

**5.21** Here it may be pertinent to refer to an earlier Table (3.16) in which motivation and atmosphere of research in the institutions have been found, on the basis of supervisors' response to be in such a state that high priority is accorded by supervisors to improve the situation. While referring to that Table, one might see that throughout the system, laboratory facilities, equipment, library and documentation are perceived to be in need of immediate attention. The scholars have, furthermore, highlighted the need for great improvement in all kinds of services necessary to support research.

**5.22** The atmosphere, more directly related to creative activity and spirit, was the subject of a question asked to both the supervisors and the scholars. They were asked to describe their perception of the general atmosphere of their laboratories in terms of: (1) innovative and optimistic, (2) creative and positive, (3) dull and unexciting and (4) mechanical and discouraging. The results are summarised in Table 5.12(a) for supervisors and Table 5.12(b) for scholars.

**Table 5.12(a) : Atmosphere of Laboratory  
(Perception of Supervisors)  
(Number/Percentage)**

|       | Valid Reply | No Reply | Innovative &<br>Optimistic | Creative &<br>Positive | Dull &<br>Unexciting | Mechanical &<br>Discouraging |
|-------|-------------|----------|----------------------------|------------------------|----------------------|------------------------------|
| Total | 735/89      | 94/11    | 122/17                     | 423/58                 | 127/17               | 63/9                         |

**Table 5.12(b) : Atmosphere of Laboratory  
(Perception of Scholars)  
(Number/Percentage)**

|       | Valid Reply | No Reply | Innovative &<br>Optimistic | Creative &<br>Positive | Dull &<br>Unexciting | Mechanical &<br>Discouraging |
|-------|-------------|----------|----------------------------|------------------------|----------------------|------------------------------|
| Total | 1930/93     | 142/7    | 255/13                     | 1228/64                | 251/13               | 196/10                       |



**5.23** The steadiness of this response between two sets of participants in research is remarkable. Confidence is certainly created in the truthfulness and sincerity with which scholars and supervisors have responded. 56%/58% of the laboratories are perceived by scholars/supervisors as having "creative" and "positive" atmosphere. 11%/17% of scholars/supervisors even find the atmosphere "innovative" and "exciting". Thus 65% to 75% laboratories can be, on the whole, placed in the positive category. This does not exactly correspond to teamwork and cooperation being "good" or "excellent" in only 55% cases [Table 5.11 (i)], or only 60% departments having an encouraging environment or the environment in 39% of the departments being "frustrating" or "callous" (Table 5.08). Once again we find, like in the case of quality of supervision earlier, that over all response tends to be more positive than a response to more specific questions about the same aspect. Nevertheless even 55% to 60% departments being positively rated, leaves a huge number in the category where the atmosphere needs to be greatly improved. There need be no complacency in this respect. It should also be remembered that the better departments are over-represented in the sample.

**5.24** The last Table, number 5.13, in this series is the response of scholars about their perception of the rules and regulations for purchase of equipment,

**Table 5.13 : Rules and Regulations Regarding Purchase of Equipment  
(Number/Percentage)**

| Category | Valid Reply | No Reply | Simple | Bureaucratic | Time Consuming | Almost Impossible |
|----------|-------------|----------|--------|--------------|----------------|-------------------|
| CU       | 629/94      | 41/6     | 151/24 | 81/13        | 298/47         | 99/16             |
| SU       | 816/93      | 57/7     | 176/22 | 87/11        | 424/52         | 129/16            |
| IIT      | 260/92      | 22/8     | 52/20  | 47/18        | 133/51         | 28/11             |
| IISc     | 217/88      | 30/12    | 60/28  | 37/17        | 111/51         | 9/4               |
| Total    | 1922/93     | 150/7    | 379/20 | 215/11       | 855/44         | 256/13            |

sanction of funds for attending seminars or inviting experts, etc. It seems that 44% of the scholars find the position to be unsatisfactory because it is "time consuming", and another 13% find the position "almost impossible" to put up with. Yet another 11% find the whole arrangement to be "bureaucratic". Only 20% of the scholars say that the rules and regulations are "simple". If one correlates this information with the fact that there are 179 departments to which these scholars belong, it would, perhaps, be clearly seen that only in a very small number of departments/universities, the position is satisfactory. This is being said because those who find the rules to be "simple" may belong to a few departments. It is notable that in the category of time consuming, more than 50% of the scholars of the IISc are represented.

## **Observance of Scientific Values : Unreliable Evaluation**

**5.25** In a study of the process by which scientific research is done in our institutions, the question of scientific values which are being observed is perhaps even more important than that of discipline, organization and human relations which have been so far explored in this Chapter. In fact, these are inter-related factors, erosion of one undermines the other. Scientific values are important precisely because their observance motivates participants to give their best to scientific work, and raises the quality of scientific contributions. Of particular importance in this connection, is objectivity and integrity in judging performance of individuals and excellence of the piece of work under scrutiny. Obviously, if one strays from objectivity, one becomes subjective and allows likes and dislikes or prejudices or ulterior motives to creep in, thus vitiating the atmosphere of the laboratories and frustrating the concerned scientists. If there is lack of integrity in collection of data or analysis and presentation of results, or in judging human performance, the result will be unscientific and devoid of intellectual value or applicability.

**5.26** Therefore, in any study of the quality of scientific research in our institutions of higher education, it is of crucial importance to see how scientific values are being observed. In this endeavour a rigorous, or even harsh, self-examination is called for, particularly on the part of teachers and supervisors.

**5.27** Defective evaluation of the performance of students in university examinations, and inter-alia, of individuals who apply for various posts to which appointments are made by selection, have already been commented on in the earlier chapters. It is very common that practically every undergraduate and postgraduate gets close to 90% or 95% marks in the laboratory examinations. Teachers who evaluate in this highly unjust manner do not even think that they are violating basic scientific and educational values by equating poor performance with those who excel. In the process, laboratory skills are downgraded. In the context of poor experimental facilities, systematic violation of objectivity in evaluation ensures that inadequately trained students are pushed from one stage of education to another.

**5.28** The inflated marks awarded to students result in the kind of embarrassment to the universities which, an earlier Table (3.10) drawn up on the basis of the analysis of the Junior Research Fellowship examination conducted by the CSIR and the UGC, has shown. Out of more than 20 thousand students with 60% or higher marks awarded by the universities, only 174 obtained 60% marks in the National Examination. 29% of such



“first class” students could not get even 20% marks in the National Examination. In the subject paper of five examinations taken together, the highest mean marks even recorded was 28%.

**5.29** Data on the recruitment of teachers, who may eventually become supervisors of research, has already been presented in Table 4.04 as data on mobility. With 90% of recruitment being made out of the existing staff in any given institution, when outwardly the recruitment has to be of the best person found anywhere in the country, the violation of objectivity and integrity is self-evident. Clearly, promotion of quality research in such a background is problematic, to say the least.

### Scientific Values : Departure From Recognition of Merit

**5.30** Considering the Indian sociological situation and the likely nature of any breach of scientific values, a question was asked of scholars in these terms:

**Table 5.14 : Supervisor's Prejudice as Perceived by Scholars**

| Factor                          | Valid Reply<br>Number | No Reply | Never<br>(In Percentage) | Occasional | Frequent | Always |
|---------------------------------|-----------------------|----------|--------------------------|------------|----------|--------|
| <b>(a) Sex</b>                  |                       |          |                          |            |          |        |
| CU                              | 601                   | 10       | 30                       | 28         | 17       | 24     |
| SU                              | 785                   | 10       | 38                       | 20         | 10       | 31     |
| IIT                             | 243                   | 14       | 18                       | 25         | 16       | 41     |
| IISc                            | 213                   | 14       | 18                       | 15         | 20       | 47     |
| Total                           | 1843                  | 11       | 30                       | 23         | 15       | 32     |
| <b>(b) Caste</b>                |                       |          |                          |            |          |        |
| CU                              | 593                   | 11       | 38                       | 20         | 18       | 24     |
| SU                              | 773                   | 11       | 36                       | 20         | 13       | 31     |
| IIT                             | 242                   | 14       | 21                       | 20         | 14       | 45     |
| IISc                            | 210                   | 15       | 22                       | 8          | 11       | 60     |
| Total                           | 1819                  | 12       | 33                       | 19         | 15       | 34     |
| <b>(c) Religion</b>             |                       |          |                          |            |          |        |
| CU                              | 592                   | 12       | 48                       | 16         | 13       | 24     |
| SU                              | 768                   | 12       | 43                       | 16         | 10       | 32     |
| IIT                             | 241                   | 15       | 24                       | 15         | 12       | 49     |
| IISc                            | 207                   | 16       | 21                       | 9          | 9        | 61     |
| Total                           | 1809                  | 13       | 40                       | 15         | 11       | 35     |
| <b>(d) Domicile</b>             |                       |          |                          |            |          |        |
| CU                              | 586                   | 13       | 38                       | 25         | 16       | 21     |
| SU                              | 748                   | 14       | 39                       | 22         | 11       | 28     |
| IIT                             | 234                   | 17       | 21                       | 26         | 12       | 41     |
| IISc                            | 205                   | 17       | 19                       | 11         | 14       | 57     |
| Total                           | 1774                  | 14       | 34                       | 22         | 13       | 31     |
| <b>(e) Non-Academic Efforts</b> |                       |          |                          |            |          |        |
| CU                              | 574                   | 14       | 39                       | 29         | 14       | 18     |
| SU                              | 745                   | 15       | 40                       | 28         | 13       | 19     |
| IIT                             | 231                   | 18       | 28                       | 28         | 18       | 27     |
| IISc                            | 199                   | 17       | 19                       | 11         | 14       | 57     |
| Total                           | 1750                  | 16       | 36                       | 27         | 16       | 22     |



“In your opinion how often a research scholar in your department would get recognition and encouragement in accordance with merit, irrespective of: sex, caste, religion, domicile or non-academic efforts”. The responses are given in Table 5.14.

**5.31** A general look at these Tables which represent the responses of scholars indicates that because of the sensitivity of the question, the percentage of scholars who have hesitated to reply is between 10% and 19%. A notable point in Table 5.14(b), where data of the IITs is given, is that the “no reply” percentage is higher, and it is the highest in the IISc. The fear in the hearts of the respondents seems to be maximum in the institutions which are well endowed and somewhat more disciplined than the others. This high percentage is to be kept in mind when the rest of the results are interpreted. It is seen from the Table representing the over all situation or “Total” that scholars “never” getting recognition and encouragement in accordance with merit range from 30% to 40%, and the utmost negative situation prevails with respect to the religion of the scholar. In the IITs, examining the same column, called “never”, shows that religious prejudice is exceeded only by distraction due to non-academic efforts. In the case of the Central universities, the higher discrimination is again on the basis of religion and it is rated at 48%. In the State universities, there is a similar situation and prejudice on account of religion is higher than even prejudice caused by non-academic efforts.

**5.32** The second column of the figures indicates “occasional” prejudice and in Table 5.14(a) where the combined data of all institutions is given, even this ranges between 15 and 27%. In order to get an idea of the percentage of the scholars who fear that they would not get recognition and encouragement, which they might deserve on the basis of merit, response figures should be seen by combining column “1” with at least half the percentages of column “2”. This means that prejudice level is as high as around 50%.

**5.33** We may at the same time look at the other side of the picture where the scholars say that they would always get recognition in accordance with merit. The percentage in Table 5.14 stands at around 33%, and it is higher in the IITs and the IISc than in the Central or State universities. The Central universities have the lowest score in this column, while one would expect them to be more cosmopolitan and “national” in character.

**5.34** An important feature here is that scholars feel that “non-academic efforts” are very important if they are to get deserved recognition of the merit, and this ranges from ordinary flattery to many other unethical practices, of which many accounts are heard in the institutions. The scores for the necessity of adopting non-academic efforts to get due recognition

are 28% in IITs, about 40% in the Central and the State universities and, 25% at the IISc.

**5.35** This is a remarkable departure from fair play and recognition of excellence, and it must be creating problems of mistrust and lack of confidence between scholars and supervisors. It must also be creating tensions among the scholars who happen to be in the same research laboratory but falling in one or the other category of targets of prejudice. One fears that what comes out as merit from such sorting and sifting on the basis of loaded considerations would often be of doubtful value. This is an area where deep-seated social and cultural factors hold sway and there is no easy remedy except determined introspection and self-correction on the part of the supervisors. It might also be necessary to introduce some special checks in the system to reduce the incidence of retrograde values.

### **Scientific Values : Unethical Practices**

**5.36** Another very sensitive factor which needed to be explored was the question of malpractices of various kinds. The question was directed to scholars in the following words : "How frequent are the following practices in your department: (a) manipulation of data, (b) forging of data, (c) using unacknowledged data from somebody else's work, (d) appointing specially considerate examiners, (e) awarding degrees inspite of very critical reports of examiners, (f) making exaggerated/false/premature claims in non-scientific forums and publications".

**5.37** Once again, a general observation about these Tables 5.15 (a to e) is that "no reply" percentages are even higher than in the set of Table 5.14. The IISc once again takes the cake with no-reply percentages running to as high as 29% of the scholars. The scholars seem to be most forthcoming in the State universities, but in this case also no-reply percentage ranges between 11 and 22%.

**5.38** For obvious reasons, the percentage of scholars showing reluctance to respond is high, hence the column representing "occasional" resorting to these malpractices, has to be given considerable weight. Scholars claiming the existence of occasional malpractices range between 20% for forging of data to 38% for appointing considerate examiners. Manipulation of data is perceived to be as high as 30%, and using unacknowledged data is also very considerable at 22%. Awarding degrees when the reports are very critical is recorded by 31% scholars in the general Table, (combining occasional and frequent). The column representing "never", perhaps, represents clean practices and here the scores run between 46% for non-appointment of considerate examiners and 77% for not making exaggerated claims. On the whole, responses show that something like 25% of the activity might suffer from one or the other malpractice.



**Table 5.15 : Prevalence of Malpractices  
(Perception of the Scholars)  
(Number/Percentage)**

| Factor                                                  | Valid Reply | No Reply | Never   | Occasional | Frequent |
|---------------------------------------------------------|-------------|----------|---------|------------|----------|
| <b>(a) Manipulation of Data</b>                         |             |          |         |            |          |
| CU                                                      | 567/85      | 103/15   | 319/56  | 188/33     | 60/11    |
| SU                                                      | 778/89      | 95/11    | 488/63  | 229/29     | 61/8     |
| IIT                                                     | 231/82      | 51/18    | 157/68  | 62/27      | 12/5     |
| IISc                                                    | 191/77      | 56/23    | 136/71  | 47/25      | 8/4      |
| Total                                                   | 1768/85     | 304/15   | 1101/62 | 526/30     | 141/8    |
| <b>(b) Forging of Data</b>                              |             |          |         |            |          |
| CU                                                      | 539/80      | 131/20   | 369/68  | 142/26     | 28/5     |
| SU                                                      | 744/85      | 129/15   | 566/76  | 146/20     | 32/4     |
| IIT                                                     | 219/78      | 63/22    | 182/83  | 30/14      | 7/3      |
| IISc                                                    | 183/74      | 64/26    | 158/86  | 24/13      | 1/0      |
| Total                                                   | 1686/81     | 386/19   | 1276/76 | 342/20     | 68/4     |
| <b>(c) Using Unacknowledged Data</b>                    |             |          |         |            |          |
| CU                                                      | 562/84      | 108/16   | 382/68  | 150/27     | 30/5     |
| SU                                                      | 753/86      | 120/14   | 574/76  | 159/21     | 20/3     |
| IIT                                                     | 222/79      | 60/21    | 175/79  | 37/17      | 10/5     |
| IISc                                                    | 186/75      | 61/25    | 157/84  | 25/13      | 4/2      |
| Total                                                   | 1724/83     | 348/17   | 1289/75 | 371/22     | 64/4     |
| <b>(d) Appointing Considerate Examiners</b>             |             |          |         |            |          |
| CU                                                      | 553/83      | 117/17   | 201/36  | 227/41     | 125/23   |
| SU                                                      | 739/85      | 134/15   | 366/50  | 260/35     | 113/15   |
| IIT                                                     | 228/80      | 54/19    | 101/44  | 104/46     | 23/10    |
| IISc                                                    | 186/75      | 61/25    | 112/60  | 55/30      | 19/10    |
| Total                                                   | 1707/82     | 365/18   | 781/46  | 646/38     | 280/16   |
| <b>(e) Awarding Degrees Inspite of Critical Reports</b> |             |          |         |            |          |
| CU                                                      | 546/81      | 124/19   | 344/63  | 161/29     | 41/8     |
| SU                                                      | 724/83      | 149/17   | 523/72  | 162/22     | 39/5     |
| IIT                                                     | 226/80      | 56/20    | 157/69  | 55/20      | 14/6     |
| IISc                                                    | 176/71      | 71/29    | 133/76  | 38/22      | 5/3      |
| Total                                                   | 1673/81     | 399/18   | 1158/69 | 416/25     | 99/6     |
| <b>(f) Making Exaggerated Claims</b>                    |             |          |         |            |          |
| CU                                                      | 531/79      | 139/21   | 405/76  | 106/20     | 20/4     |
| SU                                                      | 685/78      | 188/22   | 543/79  | 128/19     | 14/2     |
| IIT                                                     | 223/71      | 59/21    | 176/79  | 37/17      | 10/4     |
| IISc                                                    | 185/75      | 62/25    | 126/68  | 42/23      | 17/9     |
| Total                                                   | 1624/78     | 448/22   | 1250/77 | 313/19     | 61/4     |



**5.39** It is remarkable that the position with regard to malpractices is absolutely comparable between all the institutions taking into account the high level of non-responses in various institutions.

### Scientific Values : Laxity in Thesis Evaluation

**5.40** The observance of academic and scientific values in relation to the final evaluation of the thesis of Ph.D. scholars has also been studied and the results are shown in Table 5.16. The question put to the supervisors was,

**Table 5.16 : Evaluation of Theses  
(Response of Supervisors)  
(Number/Percentage)**

| Category | Valid Reply | No Reply | 1     | 2      | 3     | 4      | 5    |
|----------|-------------|----------|-------|--------|-------|--------|------|
| CU       | 295         | 12/4     | 43/15 | 150/51 | 12/4  | 78/26  | 12/4 |
| SU       | 382         | 10/3     | 33/9  | 177/46 | 16/4  | 132/35 | 24/6 |
| IIT      | 95          | 1/1      | 15/16 | 43/45  | 5/5   | 24/25  | 8/8  |
| IISc     | 34          | —        | 7/21  | 9/26   | 1/3   | 10/29  | 7/21 |
| Total    | 806/97      | 23/3     | 98/12 | 379/47 | 339/4 | 244/30 | 51/6 |

1 – Reject it outright

2 – Ask for its revision

3 – Request that it be sent to another examiner

4 – Give critical evaluation but allow it to be accepted

5 – Recommend acceptance in view of hard work put in, or because a Ph.D. programme is partly a training in research

knowing the various difficulties faced by Indian scholars, “when you examine and find a thesis to be unsound (conceptually, methodologically or analytically) would you: (1) reject it outright; (2) ask for its revision; (3) request it to be sent to another examiner; (4) give critical evaluation but allow it to be accepted; (5) recommend acceptance in view of the hard work put in, or because a Ph.D. programme is partly a training in research”.

**5.41** Perhaps it would be agreed that, in the strict sense, the proper answer to expect would be 100% supervisors indicating rejection of such a thesis. But the prevailing situation is represented by only about 12% of the supervisors responding in favour of outright rejection of a thesis which is found to be unsound in basic features. Nearly half the supervisors are for the revision of the thesis even when it is based on fallacious premises or methodology. A few percent of the supervisors are in favour of shifting the responsibility to another examiner. But what is of greater concern is that in all the institutions, nearly 1/4th to 1/3rd of the supervisors are in favour of giving critical evaluation but allowing such an unsound thesis to be accepted. This tallies very well with the earlier Table on malpractices where 31% of scholars (excluding non-response of 18%) said the same thing. Again a few percent, and in the case of IISc about 21% of supervisors, are in favour

of recommending acceptance on a compassionate ground or considering a Ph.D. programme, as merely a training programme! The lack of rigour in evaluating a piece of scientific research represented in the thesis, and a lax or indulgent attitude with regard to the highest level of intellectual performance should certainly be a matter of great concern for those who would like to cultivate quality science in India.

### Choice of Research Problems

**5.42** This study has concerned itself with several questions related to the choice of the research problem. The first is, how was the research problem decided, i.e. whose initiative and in what circumstances a problem was chosen and assigned to a research scholar. Responses of scholars were obtained and they are shown in Table 5.17. It is seen that the largest response is that the

**Table 5.17 : How Was the Research Topic Decided  
(Perception of Scholars)  
(Number/Percentage)**

| Category | Valid Reply | No Reply | 1      | 2      | 3      | 4    | 5      | 6      |
|----------|-------------|----------|--------|--------|--------|------|--------|--------|
| CU       | 630/94      | 40/6     | 77/12  | 189/30 | 90/4   | 30/5 | 110/17 | 134/21 |
| SU       | 814/93      | 59/7     | 98/12  | 273/34 | 111/14 | 32/4 | 161/20 | 139/17 |
| IIT      | 259/92      | 23/8     | 19/7   | 92/36  | 37/14  | 12/5 | 51/20  | 48/19  |
| IISc     | 225/91      | 22/9     | 19/8   | 64/28  | 23/10  | 9/4  | 97/43  | 13/6   |
| Total    | 2072/93     | 144/7    | 213/10 | 618/30 | 261/13 | 83/4 | 419/20 | 334/16 |

1 – Supervisor proposed on the basis of discussions with industry/other users

2 – Supervisor proposed on the basis of previously published work

3 – You proposed on the basis of your own reading

4 – You proposed on the basis of a bright idea that struck you

5 – Related work was already being done in the laboratory

6 – Project was already sanctioned on that topic

supervisors proposed the problem on the basis of his or her previous work. Scholars were able to propose the problem out of their own study of the subject only in 13% cases. A bright idea of a scholar formed the basis of research only in 4% cases. 20% of the scholars say that the problem given to them was related to work already going on in the laboratory; and another 16% say that it was part of a project which was already sanctioned. This seems to be the general pattern followed in all the institutions. Although the nature of the institution is different, in that the IISc is wholly a research institution, and the Institutes of Technology are, or at least should be, more in contact with industry or other users, just about 4% to 12% of the problems are proposed by the supervisors on the basis of such contact. Nearly 75% of the problems are related to previous work already in hand, in one way or another, that is, either it represents the supervisor's earlier work or the



ongoing work in a laboratory or it is part of a project sanctioned. It appears from this Table that entirely new and fresh ideas are explored in a very small minority of cases.

**5.43** The next question asked to the scholars was about the nature of their research work. The question was posed in two ways, one was with respect to the work being either pure or with possible applications, and the other was, whether it was “theoretical” or “experimental” or “field oriented”. The result is shown in Tables 5.18 (a & b). According to the perception of

**Table 5.18(a) : Nature of Research Work  
(Perception of Scholars)  
(Number/Percentage)**

| Category | Valid Reply | No Reply | 1      | 2       | 3      | 4     |
|----------|-------------|----------|--------|---------|--------|-------|
| CU       | 631/94      | 39/6     | 189/30 | 308/49  | 96/15  | 39/6  |
| SU       | 848/97      | 25/3     | 232/27 | 451/53  | 106/13 | 59/7  |
| IIT      | 253/90      | 29/10    | 64/25  | 161/64  | 28/11  | —     |
| IISc     | 243/98      | 4/2      | 95/39  | 127/52  | 10/4   | 11/5  |
| Total    | 1975/95     | 97/5     | 580/29 | 1047/53 | 240/12 | 108/5 |

1 – Pure

2 – With possible applications

3 – Applied & sponsored by agency

4 – Part of a larger national project

the scholars, about 29% of the research problems are classified as “pure”, perhaps, in the sense that the scholar sees no possible application of the investigation. 12% and 5% of the problems are either part of a larger national project or are applied and sponsored by some agency, respectively. 53% scholars, on the whole, perceive that they are involved with a problem which has possible applications. Altogether, this indicates that nearly 70% of the problems in hand, as reported by the scholars, are either applied or applicable in nature. This is a very large proportion for the university system which is usually credited with undertaking abundant pure research. The figure in many countries is something like 80% pure research and 20% applied research. Only the IISc scholars report that 39% of them are doing “pure” research. Interestingly, the Central and the State universities are doing the largest percentage of problems which are either sponsored by an agency or are part of a national project, and the IISc comes out lowest in this category. This comes, perhaps from the compulsion of Central and State universities, who are not as well endowed as IISc, to seek funds for research.

**5.44** Table 5.18(b) shows that theoretical work constitutes a very small proportion of researches in universities, if one goes by the response of 1817 scholars, where the scholars of Mathematics and Statistics have been excluded. Again, the pattern is by and large similar in all institutions. Though, the



**Table 5.18(b) Nature of Research Work  
(Perception of Scholars)  
(Number/Percentage)**

| Category | Valid Reply | No Reply | Theoretical | Experimental or<br>Field Oriented | Needs a<br>Computer |
|----------|-------------|----------|-------------|-----------------------------------|---------------------|
| CU       | 588/88      | 82/12    | 28/5        | 518/88                            | 42/7                |
| SU       | 779/89      | 94/11    | 46/6        | 681/87                            | 52/7                |
| IIT      | 232/82      | 50/18    | 16/7        | 179/77                            | 37/16               |
| IISc     | 218/88      | 29/12    | 23/11       | 154/71                            | 41/19               |
| Total    | 1817/88     | 255/12   | 113/6       | 1532/84                           | 172/9               |

Central and State universities tend to take up more experimental or field oriented research, which does not need computer application, this may be because computer facilities are often not adequate in these institutions, as indicated earlier also.

**5.45** A very large percentage of experimental or field oriented problems, 84%, and 9% problems in which a computer has to be used, has to be seen in the context of the laboratory and computer facilities in the universities being very deficient. It seems that a lot of work suffers from inadequacy of basic tools of research.

**5.46** To explore the same question in a slightly different form, supervisors' response was obtained about how they choose problems of research: (1) whether the choice is entirely from a curiosity consideration, or (2) because of possible applications, or (3) simply because the Ph.D. degree needs of the students have to be served by whatever facilities are available. A scrutiny of Table 5.19 might reveal a small discrepancy of numbers which is because a few supervisors have filled in more than one choice. But the basic data remains undisturbed. This Table, which shows the response of the supervisors, brings it out that only 12% of the problems are claimed chosen from a curiosity consideration in all the institution taken together, except the IISc where the percentage is 24. The largest response, something like 48%, is for the choice of the problem due to some "long range scheme of research" in the supervisor's mind, which implies that it is a continuation of previous work. Only about 23% of the problems have been chosen specifically because of some possible application. Application related problems are shown at 10% in the IISc. It is of interest that from 8% for the IISc to 13% for the IITs and 16% and 20% for the Central and State universities, the problems are chosen merely to satisfy the need of producing Ph.Ds. Needless to say, there is great consistency of pattern in all the institutions. Once again the goal related problems dominate, and the "curiosity related" problems are in a small minority.

**Table 5.19 : How Are Problems of Research Chosen  
(Response of the Supervisors)  
(Number/Percentage)**

| Category | Total | 1      | 2      | 3      | 4      |
|----------|-------|--------|--------|--------|--------|
| CU       | 351   | 41/12  | 178/51 | 75/21  | 57/16  |
| SU       | 462   | 46/10  | 201/44 | 121/26 | 94/20  |
| IIT      | 126   | 19/15  | 61/48  | 29/23  | 17/13  |
| IISc     | 41    | 10/24  | 24/58  | 4/10   | 3/8    |
| Total    | 980   | 116/12 | 464/47 | 229/23 | 171/17 |

Note : Total response is high due to more than one alternatives chosen in many cases

1 – Entirely from a curiosity consideration

2 – Because of a long range scheme of research in your mind

3 – Because of possible applications

4 – Because of the Ph.D. degree needs of student have to be served by the available facility

**5.47** Yet another question directed to the supervisors was in the form: “is any of your research programmes connected with the national thrust areas/national technical missions.” In order to be more definite, the supervisors were asked, to give some specification of the concerned mission or national thrust. In response to this question, out of 822 supervisors who filled the entry, only 88 were able to give specification of the problem. This number leads to a percentage of 9 and it tallies with the response of the scholars for their problem being part of some national project or work sponsored by research agency.

**5.48** The question of relationship with national thrust areas has arisen since there was a lot of publicity given to the concept and “thrust areas” were discussed in many seminars in the country. Apart from this, it was expected that both the supervisors and the scholars would be, at least, informed about the major national research activities in their own fields. For example, there are major programmes of research and advanced facilities are being set up in bio-technology, micro-electronics, astronomy, nuclear science, etc. It was desired to know how far people in the institutions were even aware of major research activities. Along these lines a question was directed both to supervisors and scholars, and in order not to receive vague and general answers, respondents were asked to clearly specify at least two examples of such work. Table 5.20 (a & b) give the responses which have been obtained. About 22% of the supervisors were able to give the two specified examples and, therefore, they can be considered to be well informed about the frontline work going on in India in their own or related fields. But this leaves almost 75% to 80% of the senior people in the university system and the IITs not being aware of such research activity to the extent desired. Another 17% people were able to give only one example and at best they can be considered partly informed. The IITs came out a little better at the single example, scoring 34%.



**Table 5.20 (a) : Awareness about National Research Activities  
(Response of Supervisors)  
(Number/Percentage)**

|       | Valid Reply | No Reply | One Example | Two Examples |
|-------|-------------|----------|-------------|--------------|
| Total | 822         | 190/23   | 156/19      | 181/22       |

**5.49** Table 5.20(b) which records the scholars' response is very similar and 84% of the scholars involved in research were not able to give any description of major frontline work going on in India or major facilities being set up. Full two examples were given by as few as 5% of the scholars, and, scholars of all the institutions seem to be equally ignorant. One example was also provided by just 11% of the scholars, and no institution did better than the other.

**Table 5.20(b) : Awareness of National Research Activities  
(Response of Scholars)  
(Number/Percentage)**

|       | No Reply | One Example | Two Example |
|-------|----------|-------------|-------------|
| Total | 1737/84  | 227/11      | 108/5       |

### **Time Taken to Complete Various Stages of the Ph.D. Programme: Wastage and Delays**

**5.50** The processes of research can be studied in an entirely different manner if one breaks down the process into its various stages and examines how scholars of various subjects and institutions proceed through these stages as a function of time. The duration of some of the stages is related to sociological factors, for example, whether scholars join research immediately after passing their M.Sc. degree, or if they leave half way through because of getting a job or perhaps proceeding abroad. The time taken for evaluation of thesis and processing the information through the various university committees is something which is related to the rules and regulations and the efficiency of the administrative set up. Time taken for the process between the registration for research and submission of thesis is related to the scholar's aptitude and capabilities, intrinsic difficulties of different fields of research, problems related to equipment etc., the effectiveness of the interaction between the scholar and supervisor, and lastly the competence with which the supervisor discharges his or her responsibility. This is a long series of questions and some investigation of it is certainly possible. To the extent it is possible, an effort has been made to analyse the situation on the basis of data obtained on a proforma, directly from 27 institutions in the sample,



regarding particulars of scholars who enrolled between the years 1975 and 1985. As mentioned earlier, there were many difficulties and delays in obtaining this information and finally it was possible to get 9,906 responses whereas about 15,000 were expected. Some information in individual cases was incomplete in one proforma, and some in another, therefore, the useful or valid number of proforma with regard to various points of the enquiry is different. Nevertheless, the data runs into thousands and spreads over a long span of time, therefore, the time estimates for various processes and the differentials between various subject areas are fairly reliable. At least no such information was collected earlier and no such estimates have been made before.

**5.51** Table 5.21 provides information regarding the gap between the qualifying examination and registration for the Ph.D. degree in two spans of five years, namely 1975 to 1979 and 1980 to 1985. It is seen from this information that 46% of the scholars registered for the Ph.D. degree within two years of passing the qualifying examination.

**Table 5.21 : Gap between Qualifying Exam and Registration for Ph.D.  
(in Years)  
(Number/Percentage)**

| Year of<br>Registration | Valid Reply | No Reply | ≤ 2     | ≤ 4    | ≤ 6   | ≤ 8   | > 8     |
|-------------------------|-------------|----------|---------|--------|-------|-------|---------|
| 75-79                   | 2630        | 1581     | 1212/46 | 231/9  | 124/5 | 111/4 | 952/36  |
| 80-85                   | 3258        | 2308     | 1273/39 | 401/12 | 169/5 | 131/4 | 1284/39 |

**5.52** One important significance of Table 5.21 is that around 50% of the scholars begin research within four years of passing the qualifying examination, and another 50% join later. Since the average age of the currently enrolled scholars from Table 3.04 is found to be 29 years, the above data fits into it, giving the average age at the time of entering a Ph.D. programme as about 26 years. Secondly, Table 5.21 shows that quite a large percentage of people take up research many years after passing the M.Sc. examination, and these could largely be teachers. Thirdly, the data shows that there is a tendency to join research after a longer period in the span 1980-85 than in 1975-79. Detailed breakup of these figures, institution-wise, confirms this position for Central and State universities, but the reverse is true for the IITs.

**5.53** After joining research, the other main stages in the course of Ph.D. work can be identified as follows:

- (a) Between joining research and registration for Ph.D. degree,
- (b) Between registration and submission of thesis,

- (c) Between submission of thesis and receiving the last report of examiners,
- (d) Between examiners' reports and viva-voce,
- (e) Between viva-voce and declaration of result, and
- (f) Between declaration of result and award of degree.

**5.54** The time required for each one of the above processes has been determined on the basis of the massive data obtained from the institutions. It is not necessary to present all the data in the tabulated form, but the longer time gaps will be discussed with the help of relevant Tables in some detail.

**5.55** Item (b) mentioned above, namely the time required to be spent in the main process of research, has been tabulated for each subject. This allows, first of all, the drop out rate (i.e. percentage of the registrants not actually submitting a thesis even in eight years) to be found for each subject, which otherwise is just not available with the institutions. The median number of years required to complete the Ph.D. work, the point of time when 75% of the scholars complete their work, which has been called the "third quartile," and the general span of time required by the last 25% of the scholars to complete their work, can all be worked out. To illustrate how the data has been tabulated and figures arrived at, Table 5.22 is provided here for Chemistry, with the particulars of data for registration and submission of thesis from the universities. Similar charts have been made for all subjects and all sets of institutions. From this Table a graph can be drawn to show

**Table 5.22 : Time Gap between Registration & Submission of Thesis  
(in Years)  
(Number/Percentage)**

| Year of<br>Registration                  | Valid Data | No<br>Response | ≤ 2    | ≤ 3    | ≤ 4    | ≤ 5    | ≤ 6    | ≤ 7  | ≤ 8  | > 8 |
|------------------------------------------|------------|----------------|--------|--------|--------|--------|--------|------|------|-----|
| <b>Subject : Chemistry in University</b> |            |                |        |        |        |        |        |      |      |     |
| 75                                       | 146        | 72             | 11/7   | 32/23  | 39/27  | 32/22  | 13/9   | 10/7 | 7/5  | 1/1 |
| 76                                       | 191        | 51             | 12/6   | 44/23  | 53/28  | 42/22  | 17/9   | 15/8 | 5/3  | 3/2 |
| 77                                       | 176        | 70             | 22/13  | 52/29  | 38/22  | 40/23  | 15/8   | 9/5  | -    | -   |
| 78                                       | 186        | 46             | 17/9   | 47/25  | 51/27  | 30/16  | 25/13  | 5/3  | 8/4  | 3/2 |
| 79                                       | 169        | 33             | 18/11  | 46/27  | 43/25  | 27/16  | 22/13  | 6/4  | 5/3  | 2/1 |
| 80                                       | 135        | 42             | 9/7    | 37/27  | 39/29  | 28/21  | 19/14  | 2/1  | 1/1  | -   |
| 81                                       | 208        | 36             | 24/11  | 48/23  | 46/22  | 51/24  | 22/11  | 13/6 | 4/2  | -   |
| 82                                       | 215        | 51             | 42/19  | 56/26  | 53/25  | 34/16  | 28/13  | 2/1  | -    | -   |
| <b>Total/Average<br/>Percentage</b>      | 1426       | 401            | 155/11 | 363/25 | 362/25 | 284/20 | 161/11 | 62/4 | 30/2 | 9/1 |

the percentage of scholars versus the time they take for going through the process. The related graph is shown in Fig.5.1.

### TIME TAKEN TO SUBMIT THESIS AFTER REGISTRATION

UNIVERSITIES (Chemistry)  
(YEAR OF REGISTRATION 1975-82)

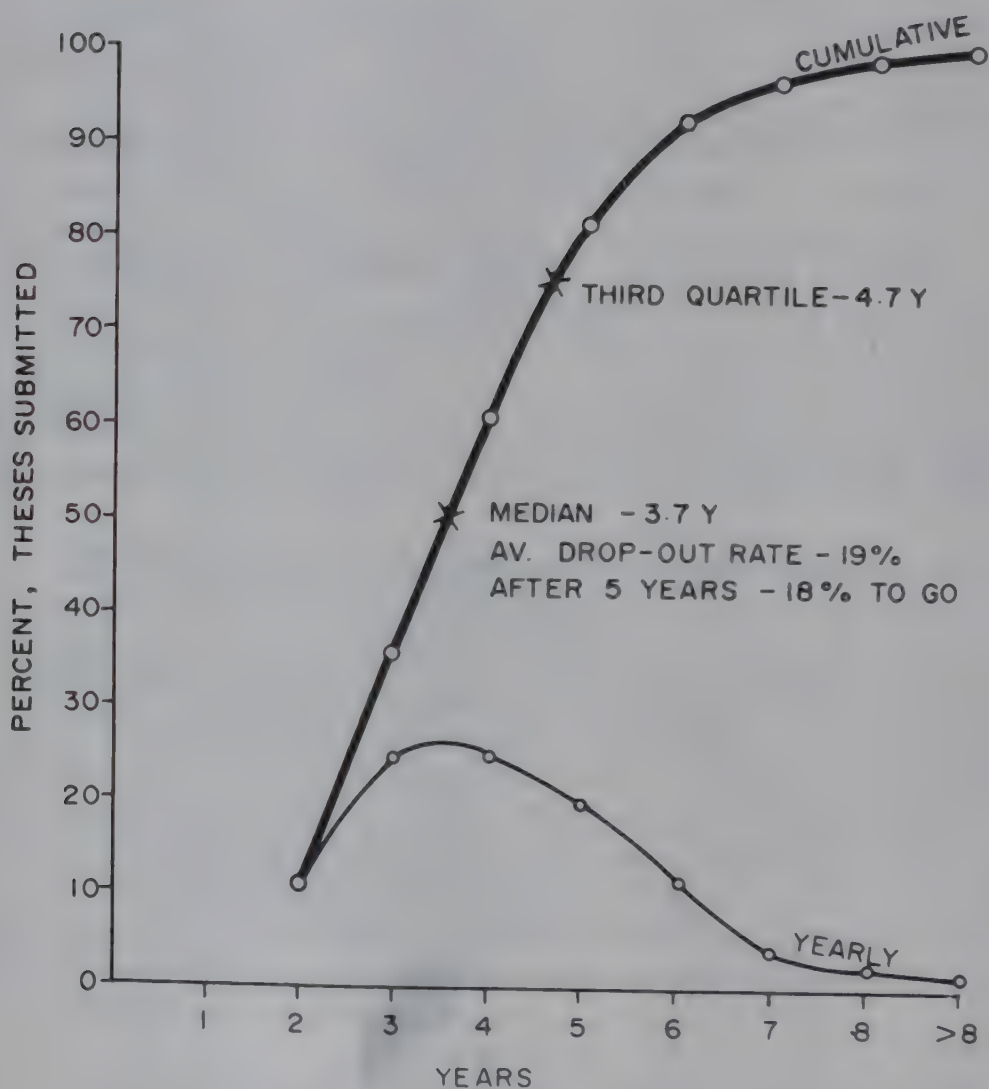


Fig. 5.1



**5.56** The analysis of such enormous data leads to a consolidated presentation of Table 5.23.

**Table 5.23 : Details of Drop-out Rate and Time Taken to Submit Thesis  
IITs vs Universities**

| Department     | Valid Data |       | Drop-out Rate<br>(in Percentage) |       | Median<br>(in Years) |       | Third<br>Quartile<br>(in Years) |       | Percentage to<br>go on after 5<br>Years |       |
|----------------|------------|-------|----------------------------------|-------|----------------------|-------|---------------------------------|-------|-----------------------------------------|-------|
|                | IIT        | Univ. | IIT                              | Univ. | IIT                  | Univ. | IIT                             | Univ. | IIT                                     | Univ. |
| Physics        | 273        | 597   | 22                               | 32    | 4.2                  | 4.0   | 5.3                             | 5.0   | 31                                      | 24    |
| Chemistry      | 307        | 1426  | 10                               | 19    | 4.2                  | 3.7   | 4.8                             | 4.7   | 10                                      | 18    |
| Mathematics    | 206        | 210   | 18                               | 41    | 3.8                  | 3.4   | 4.6                             | 4.7   | 12                                      | 21    |
| Earth Sciences | 57         | 148   | #                                | 55    | 4.1                  | 4.1   | 4.8                             | 5.3   | 21                                      | 32    |
| Zoology        | *          | 380   | *                                | 39    | *                    | 3.9   | *                               | 4.8   | *                                       | 17    |
| Botany         | *          | 466   | *                                | 35    | *                    | 3.9   | *                               | 4.9   | *                                       | 24    |
| Bio-Sciences   | *          | 468   | *                                | 23    | *                    | 3.5   | *                               | 4.8   | *                                       | 21    |
| Statistics     | *          | 43    | *                                | 53    | *                    | 4.0   | *                               | 5.2   | *                                       | 35    |
| Total          | 843        | 3738  | 15                               | 31    | 4.1                  | 3.8   | 4.9                             | 4.8   | 22                                      | 21    |

# Subject exists only at IIT Kharagpur and they supplied data only for those who completed Ph.D. degree

\* Subject does not exist at IITs

Note: Data pertains to the scholars registered between 1975-82.

**5.57** This Table shows, first of all, that the drop-out rate at the IITs for each subject is much less, and on the average half of that in the universities. This most probably represents greater purposiveness and better discipline of operation in the IITs.

**5.58** The drop-out rates vary a great deal from subject to subject, and the example of Chemistry that is given in some detail in Table 5.22 happens to be the lowest, a drop-out rate of 19%. The Earth-Sciences and Statistics have drop-out rates of more than 50%. Next comes Mathematics with a drop-out rate of 41%; Physics, conventional Zoology and Botany are 32%, 39% and 35% respectively. Bio-Sciences at 23% is only bettered by Chemistry. The average drop-out rate for all institutions and for all subjects in the universities is 31%. Unfortunately, sufficient information was not available from the institutions to find the percentage of scholars dropping out at various points of time, for example within six months or one year of registration, and so on. What has been represented above as the drop-out rate is perhaps, the minimum, because in some cases the data supplied by the institutions pertained only to those who have completed the Ph.D. programme. It is obvious that this high drop-out rate represents a tremendous loss to the system, when the resources available are already seriously limited. Reducing the drop-out rate by suitable steps would reduce the flabbiness of the system,

improve its efficiency and even improve the atmosphere of the laboratories by exclusion of scholars with casual interest in research. On the other hand, it has been pointed out that scholars are often engaged in research while they are waiting for jobs, and they leave research as soon as they can find suitable employment. An in-depth study based on individual cases needs to be carried out on these aspects.

**5.59** The median number of years to complete the work has been shown in Table 5.23 for each subject and the differences are not very great. Bio-sciences, on an average, need 3.5 years, whereas Earth-sciences, require 4.1 years. It is also noted that the median is higher for the IITs, which may be because the IITs have a course based pre-Ph.D. programme, while only a few of the universities have such a programme. But the median is not as illustrative as, perhaps, the 3rd quartile. Here, we find that the overall average of the universities is 4.8 years and of the IITs 4.9 years. This means that at the third quarter point, the IITs and the universities draw together.

**5.60** Another way of looking at the information is, what percentage of scholars are still in the stream after a passage of 5 years? On the whole, more than 20% scholars take more than 5 years to submit their thesis after the registration for the Ph.D. degree. After a lapse of five years, in some cases, as many as 30% scholars have not completed their thesis. The point is illustrated by Figure 5.2 which represents the general position of the universities for all subjects and it shows that even after 6 years, 12% scholars have yet to submit their thesis, after 7 years another 6% are left over.

**5.61** Figure 5.2 leads to two comments. Firstly, one finds that in the universities nearly 33% scholars complete their work within 3 years, and 10% do so even within 2 years. Such good speed is probably due to a conjunction of many favourable factors, the intrinsic ability of the scholar may be only one of them. Some detailed study of cases in this category needs to be done to find out why some scholars take so little time. On the other hand, the fairly large percentage of scholars who take too long a period to complete their work and, who in a sense, overstretch the system by prolonged stay in the laboratories, also needs in-depth study. If this percentage could be cut down from what it is, a much improved and more efficient system would result.

**5.62** The other component which takes a long bit of time is the lapse of time between submission of thesis and the coming in of the report of the

## TIME TAKEN TO SUBMIT THESIS AFTER REGISTRATION

UNIVERSITIES (General)  
(YEAR OF REGISTRATION 1975 - 82)

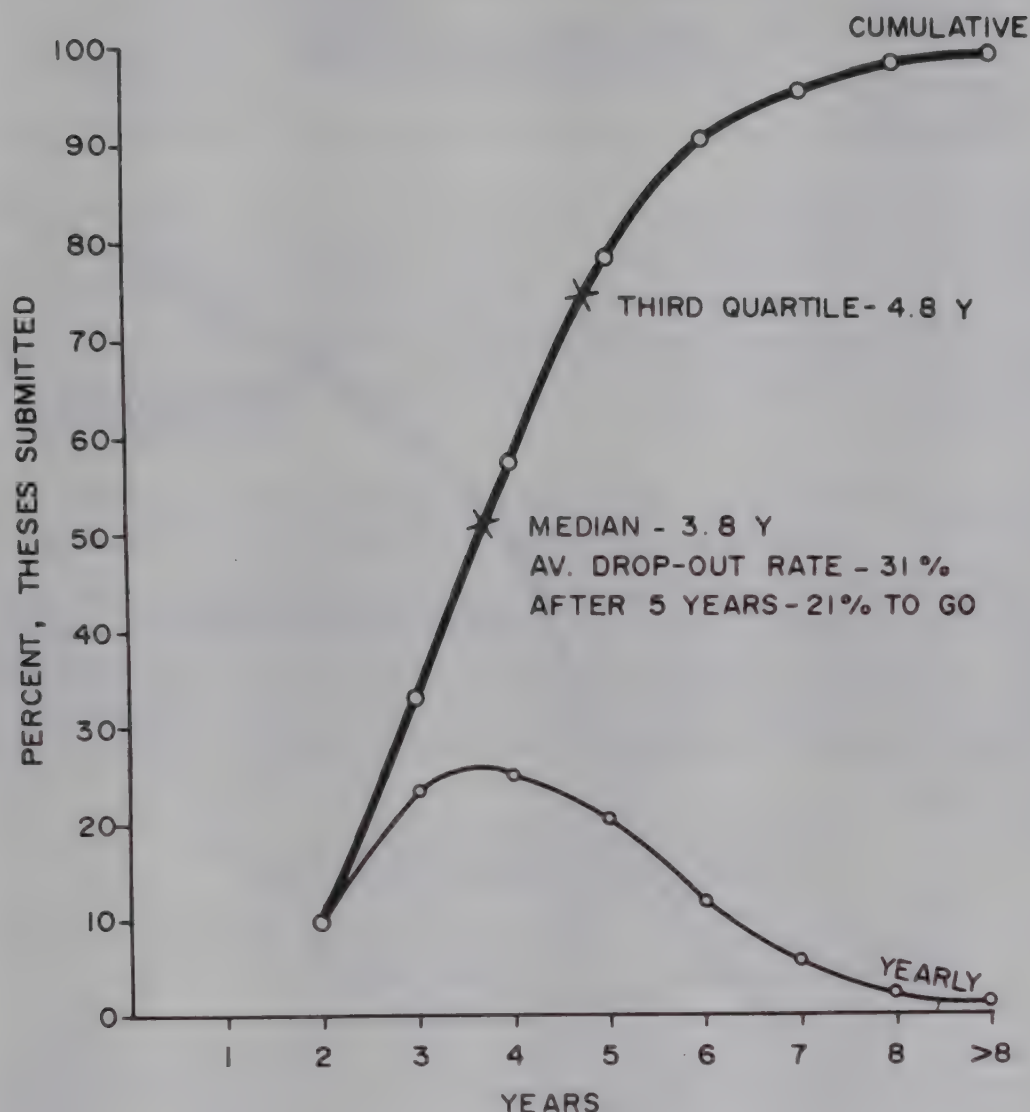


Fig 5.2

last examiner. Figure 5.3, which is based on an extensive compilation of data, sums up the position in this respect. Here one finds that in only 7% cases the time required by examiners to evaluate the thesis and submit their report is two months. The median point is at 5.3 months, and the three-quarter point is at 8.4 months. 10% of the theses take 12 months or more to be cleared. This period is of prolonged idleness and agony for the scholars. Idleness, because they have completed their work and most of the time they are not adding anything to their research. Agony, because they are uncertain of what the result will be; there are uncertainties with regard to fellowships



as well as employment. There certainly must be ways to cut down this period substantially.

### TIME BETWEEN SUBMISSION OF THESIS & REPORT OF LAST EXAMINER

(ALL INSTITUTIONS, ALL SUBJECTS)

YEAR OF REGISTRATION 1975 - 85

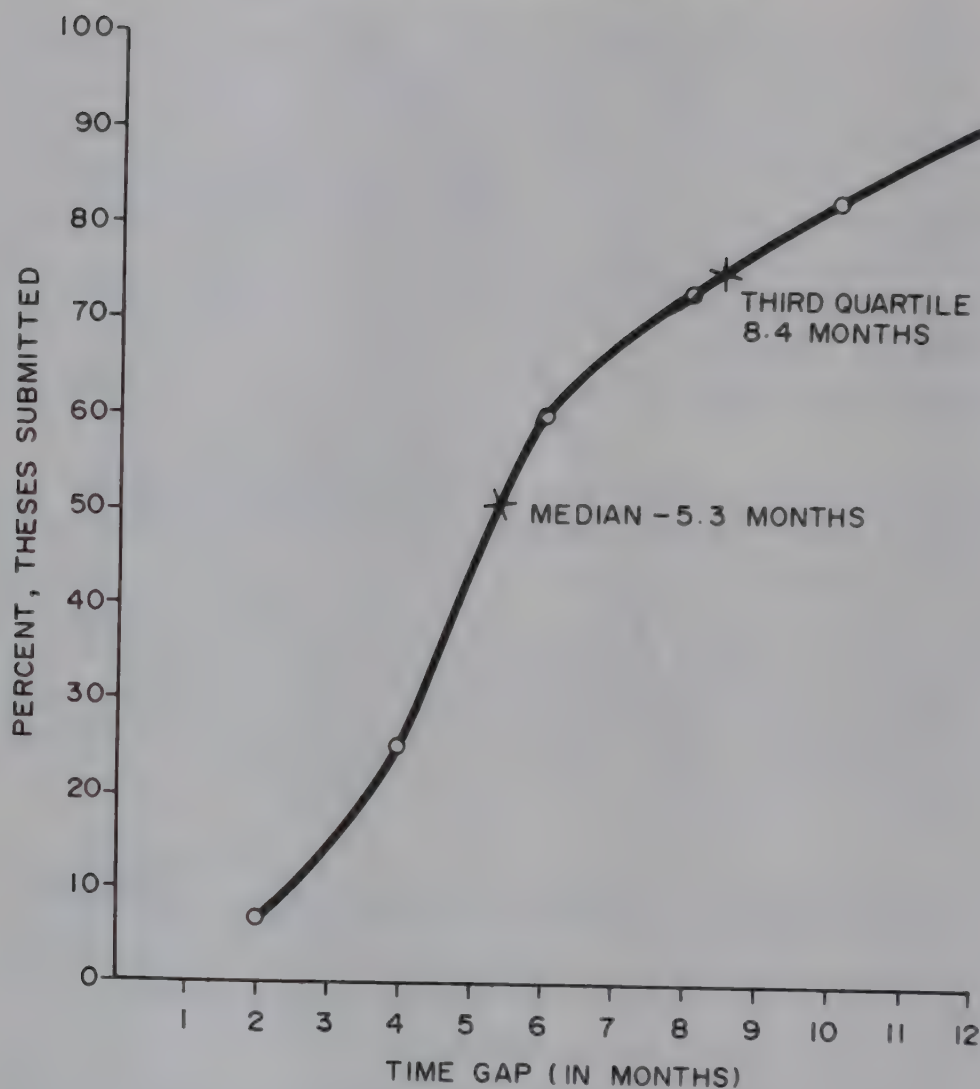


Fig 5.3

**5.63** There is another long period between the declaration of results and the award of a degree, which is because of the formalities, which are formidable in many universities, and sometimes even one year or more may lapse before the degree is awarded.

**5.64** The overall span of time from joining research to the declaration of result, on the basis of time on the third quartile point has been figured out

and it is shown in the chart below.

- |                                                                        |              |
|------------------------------------------------------------------------|--------------|
| (a) Joining research and registration                                  | - 1.5 months |
| (b) Registration to submission of thesis                               | - 58 months  |
| (c) Submission of thesis to receipt of the last report of the examiner | - 8.4 months |
| (d) Last report of examiner to holding of the viva-voce                | - 1.4 months |
| (e) Holding of viva-voce to declaration of results                     | - 1.3 months |

**5.65** This data shows that 75% of the scholars go through the Ph.D. programme within 5 years and 10 months, in other words, 25% of the scholars take more than 5 years and 10 months, a good number, like 10% or 12%, takes 7 years or more. The normal period for which a Fellowship is awarded being 3 to 4 years, provision of relaxing the rule in suitable cases may also be considered.

**5.66** The large volume of data obtained for carrying out the analysis, has also allowed two other interesting conclusions to be drawn.

(1) If the time taken for submission of the thesis is taken as a basis of assessing the success of scholars who receive the Ph D. degree, then the time taken for those, who had a first division from the institutions and those with a second division from the same institutions is shown in Table 5.24. Strangely there is very little difference between the performance of these two categories.

**Table 5.24 : Division/Fellowship-wise Duration Taken  
Data for Scholars Registered between 1975-79**

| Category    | Valid data | Date of Submission of thesis not known<br>(Number) | Time taken in years<br>(Number/Percentage) |        |        |
|-------------|------------|----------------------------------------------------|--------------------------------------------|--------|--------|
|             |            |                                                    | ≤ 4                                        | ≤ 5    | > 5    |
| I Division  | 1429       | 478                                                | 786/55                                     | 363/25 | 280/20 |
| II Division | 447        | 179                                                | 239/53                                     | 102/23 | 106/24 |
| Paid        | 747        | 236                                                | 387/52                                     | 204/27 | 156/21 |
| Unpaid      | 2009       | 923                                                | 1061/53                                    | 447/22 | 501/25 |

(2) Secondly, the performance of those who receive some kind of scholarship, and others who remain unpaid has been compared in the same Table, and in this case also, there is hardly a difference. These two conclusions which are based on fairly large numbers involved in all these cases, lead to the observation that once the student joins the stream of research, the performance, on the average, is more a function of the system than of minor differences of academic record or financial support. What is then the significance of the selection procedure and awarding of Fellowships to some and not to others, becomes an open question. This is unbelievable, in a sense,

because the academic community puts such a great deal of stock in dividing students into various categories and ranks. Is it because the evaluation system in our institutions is quite meaningless? It could be strongly argued that the academic programme, as well as the evaluation of that programme, completely ignores the creative faculties and many other competencies which are of great importance in research. Therefore, from the division a student gets in an examination, it is not possible to predict the performance in research, which is a very different kind of activity.

### Connectivity and Linkages in Research

**5.67** In the process of research, efficient functioning of many inter-related units is necessary. Linkages between institutions, and between user agencies and research institutions are needed to ensure flow of ideas and experiences, they also allow sharing of facilities, and represent appreciation of each other's role in development and progress. In this broad field, some questions were asked of the scholars and supervisors in order to assess the situation.

**5.68** Table 5.25 pertains to the sharing of facilities. The Table represents responses of scholars to the question whether the major facilities of the laboratories of their department are available to all scholars, and if the major facilities in other departments are easily available to all the scholars. Notable features are that, even within departments, research facilities of one section or unit are not available to scholars in other sections or units to the extent of 38% in the IITs and 44% of the responding scholars from the Central

**Table 5.25 : Sharing of Major Facilities  
(Response of the Scholars)  
(Number/Percentage)**

| Category                                                      | Yes     | No      |
|---------------------------------------------------------------|---------|---------|
| <b>(a) Availability of the Departmental Facilities to all</b> |         |         |
| CU                                                            | 374/56  | 296/44  |
| SU                                                            | 485/56  | 388/44  |
| IIT                                                           | 174/62  | 108/38  |
| IISc                                                          | 194/79  | 53/21   |
| Total                                                         | 1227/59 | 845/41  |
| <b>(b) Inter-Departmental Sharing of Major Facilities</b>     |         |         |
| CU                                                            | 218/33  | 452/67  |
| SU                                                            | 281/32  | 592/68  |
| IIT                                                           | 104/37  | 178/63  |
| IISc                                                          | 102/41  | 145/59  |
| Total                                                         | 705/34  | 1367/66 |



and State universities. In this respect the situation in the IISc is much better. In the interdepartmental availability of facilities, naturally, the situation is, but, worse. Of the responding scholars, 63% in the IITs and about 68% in the universities say that major facilities which are situated in other departments are not easily available to them. Even in the IISc, nearly 60% of the scholars say that they would not be able to easily use a major facility if it happens to be in another department.

**5.69** Another Table is provided giving responses to a question which was phrased slightly differently. The scholars were asked if in the course of their

**Table 5.26 : Availing of other Facilities by Scholars**  
(Number/Percentage)

| Category                                      | Yes    | No      |
|-----------------------------------------------|--------|---------|
| <b>(a) In Other Departmental Laboratories</b> |        |         |
| CU                                            | 246/37 | 424/63  |
| SU                                            | 326/37 | 547/63  |
| IIT                                           | 118/48 | 164/52  |
| IISc                                          | 137/55 | 110/45  |
| Total                                         | 827/40 | 1245/60 |
| <b>(b) In Other Departments</b>               |        |         |
| CU                                            | 202/30 | 470/70  |
| SU                                            | 232/27 | 641/63  |
| IIT                                           | 105/37 | 177/63  |
| IISc                                          | 116/47 | 131/53  |
| Total                                         | 655/32 | 1417/68 |
| <b>(c) In Other University/Institution</b>    |        |         |
| CU                                            | 183/27 | 487/73  |
| SU                                            | 342/39 | 531/61  |
| IIT                                           | 88/31  | 194/69  |
| IISc                                          | 31/13  | 216/87  |
| Total                                         | 644/31 | 1428/69 |

research, they have used facilities of other labs in the same department, and if they have used facilities in other departments, or if they have used such facilities in other institutions. Table 5.26 shows that more than 2/3rd of the scholars have not used facilities in another laboratory of their own department, or those existing in other departments of the same institution, or facilities in any other institution. The situation is practically the same in all types of institutions. Table 5.27 is a response of the supervisors to a question whether they avail the help of specialists from outside for their

**Table 5.27 : Availing the Help of Specialist from Outside**  
(Response of the Supervisors)  
(Number/Percentage)

|       | Valid Reply | No Reply | Yes    | No     |
|-------|-------------|----------|--------|--------|
| Total | 766/93      | 64/7     | 316/41 | 450/59 |

research work. Here, again, one finds that nearly 60% of the supervisors say that they do not use any specialist from outside their own department or institution in connection with their research.

**5.70** The scholars were asked another question regarding whether they had sought guidance from any experts in their field who did not belong to their own university or institution. Table 5.28 gives the data and one finds that

**Table 5.28 : Scholars Who have Sought Guidance from Experts Outside Their University/Institution (Number/Percentage)**

| Category | Yes    | No      |
|----------|--------|---------|
| CU       | 168/25 | 502/75  |
| SU       | 258/30 | 615/70  |
| IIT      | 69/24  | 213/76  |
| IISc     | 31/13  | 216/87  |
| Total    | 526/25 | 1546/75 |

70% to 87% scholars, in different institutions among those in the sample of 27, have not sought guidance in any matter from experts in other institutions.

**5.71** Yet another question put to the scholars was whether they were in contact with other research workers who were working on a problem similar/related to their field of study. Table 5.29, which is a response of the scholars in this connection, again surprisingly, indicates that 70% of the scholars are not in contact with others who are investigating problems similar to their own. This is a high degree of insularity or lack of communication

**Table 5.29 : Contact with Other Research Workers (Response of Scholars) (Number/Percentage)**

| Category | Yes    | No      |
|----------|--------|---------|
| CU       | 195/29 | 475/71  |
| SU       | 291/33 | 582/67  |
| IIT      | 66/23  | 216/77  |
| IISc     | 58/23  | 189/77  |
| Total    | 610/29 | 1462/71 |

and contact in research, since it may be presumed that people would try to be up-to-date with what anybody else might be doing with regard to a problem which is similar to their own.

**5.72** On the question of using library/documentation services available in other departments of the institution or in another institution, scholars gave responses which are consistent with relative lack of sharing of facilities already reported. Table 5.30 gives the data, and it is found that literature in other

**Table 5.30 : Using of Library/Documentation Services**  
(Response of Scholars)  
(Number/Percentage)

| Category                                   | Yes    | No      |
|--------------------------------------------|--------|---------|
| <b>(a) In Other Departments</b>            |        |         |
| CU                                         | 293/44 | 377/56  |
| SU                                         | 297/34 | 576/66  |
| IIT                                        | 55/20  | 227/80  |
| IISc                                       | 59/24  | 188/76  |
| Total                                      | 704/34 | 1368/66 |
| <b>(b) In Other University/Institution</b> |        |         |
| CU                                         | 316/47 | 601/53  |
| SU                                         | 397/45 | 476/55  |
| IIT                                        | 132/47 | 150/53  |
| IISc                                       | 36/15  | 211/85  |
| Total                                      | 845/41 | 1227/59 |

departments is not widely used, only 20% of the IITs scholars, 34% of scholars from the State universities and 44% of the Central universities gave a positive response. The scholars in the Central universities seem to be a little more inter-disciplinary, because, in this context, the meaning of using books and journals in other departments is precisely that. The use of literature available in other institutions happens to be slightly more than that in other departments, because here, perhaps, journals and books of the same subject are being used.

**5.73** The UGC has set up a national service for providing abstracts of current articles and copies of papers to all researchers in science. The question was asked, whose response is given in Table 5.31, asking scholars if they were even aware of the existence of such a service, for which, it is said that a lot of

**Table 5.31 : Awareness of UGC Science Information Service**  
(Response of Scholars)  
(Number/Percentage)

| Category | Yes    | No      |
|----------|--------|---------|
| CU       | 252/38 | 418/62  |
| SU       | 358/41 | 515/59  |
| IIT      | 139/49 | 143/51  |
| IISc     | 177/72 | 70/28   |
| Total    | 926/45 | 1146/55 |



publicity has been given. The Table tells us that 60% of the Central and State university scholars are unaware of this service, and 50% of those in the IITs also do not know about it. Strangely, even in the IISc, where this service is located, 28% of the scholars are apparently unaware of its existence.

**5.74** Exploring the contacts and involvement of supervisors with the research work of other agencies was taken up through some questions. Table 5.32 sums up the response to the question asking the supervisors if they are

**Table 5.32 : Involvement in the Research Work of Other Agencies  
(Response of the Supervisors)  
(Number/Percentage)**

| Category | Valid Reply | 1      | 2     | 3    | 4      |
|----------|-------------|--------|-------|------|--------|
| CU       | 298         | 38/13  | 32/11 | 8/3  | 220/74 |
| SU       | 392         | 81/21  | 25/6  | 13/3 | 273/70 |
| IIT      | 96          | 15/16  | 14/15 | 5/5  | 62/65  |
| IISc     | 34          | 1/3    | 7/21  | 3/9  | 23/67  |
| Total    | 820         | 135/16 | 78/10 | 29/4 | 578/70 |

1 – As a partner in cooperative research programme

2 – As a member of their committee

3 – In planning and development of the agency's programme

4 – Not connected

involved in the research work of other agencies, whether (1) they are involved as a partner in a cooperative research programme or (2) as a member of their research committee or (3) in planning and development of the agencies' programme. The response shows that 65% to 74% of the supervisors are not involved at all, and this confirms the findings reported earlier. 13% of supervisors in the Central universities, 16% in the IITs, and 21% in the State universities are cooperating in the agencies' research programme as a partner. This probably means that they are carrying out some projects sponsored by the agencies. The State universities are recipients of this kind of project support to a larger extent than the Central universities or the IITs. According to this Table, the IISc is involved to a smaller extent than the other institutions. Participation as a member of various committees is reported as 21% from IISc, which is the highest percentage amongst all the institutions, then come the IITs with 15%, the State universities with 11%, and the Central universities with 6%. Participation in planning and development of the agencies' programme is very marginal, only a few percent of the supervisors being involved in this work, except perhaps for the IISc, where 9% of the supervisors have reported such participation.

**5.75** In Table 5.33 the enquiry is about the existence of a systemic link, or a supervisor being a part of the network for any research study undertaken

**Table 5.33 : Systemic Link with Other Department/Institution  
(Response of the Supervisors)  
(Number/Percentage)**

| Category                                | Yes    | No     |
|-----------------------------------------|--------|--------|
| <b>(a) Industry/User Agency</b>         |        |        |
| CU                                      | 7/2    | 297/98 |
| SU                                      | 11/3   | 327/97 |
| IIT                                     | 8/9    | 86/91  |
| IISc                                    | 4/12   | 30/88  |
| Total                                   | 30/4   | 740/96 |
| <b>(b) Research Agency</b>              |        |        |
| CU                                      | 102/33 | 203/67 |
| SU                                      | 112/33 | 227/67 |
| IIT                                     | 32/34  | 63/66  |
| IISc                                    | 10/29  | 24/71  |
| Total                                   | 256/33 | 517/67 |
| <b>(c) Other University/Institution</b> |        |        |
| CU                                      | 85/28  | 219/72 |
| SU                                      | 109/32 | 229/68 |
| IIT                                     | 29/31  | 65/69  |
| IISc                                    | 6/18   | 28/82  |
| Total                                   | 229/30 | 541/70 |

by the supervisor's department in cooperation with a research agency, or industry or user agency. This Table shows that only about 1/3rd of the supervisors are involved, whereas 2/3rd are not involved in such a link with research agencies. In a way, this again confirms what has been stated earlier, for example, in Table 5.32, but it seems that the idea of a systemic link was not quite understood by the supervisors. Again approximately 1/3rd of the supervisors have such links and more than 2/3rd do not have any such connection. At the IISc, people not involved with other educational institutions seem to be higher in percentage. It is feared that the word systemic may not have been properly understood here also, since the involvement might be as paper-setters and examiners etc. Inter-university cooperative research projects are not known to be so numerous at all.

**5.76** With regard to link with industry, the position seems to be that only at the IISc, 12% supervisors seem to have some link with industry or user agency. 9% supervisors of IITs claim to have such links. But the Central and State universities have hardly any links of this kind, only 2% or 3% of the supervisors having responded positively to this section of the question.

**5.77** Supervisors were also asked the question regarding agencies which have supported their research at one time or another. The response given in Table 5.34 indicates, once again, that the UGC and the CSIR take a major share of

**Table 5.34 : Sponsoring Agency  
(Response of the Supervisors)**

| Agency       | Total | Percentage |
|--------------|-------|------------|
| UGC          | 326   | 31         |
| DST          | 110   | 10         |
| CSIR         | 263   | 25         |
| DAE          | 72    | 7          |
| DOE          | 12    | 1          |
| ICMR         | 28    | 3          |
| ICAR         | 29    | 3          |
| State Govt.  | 12    | 1          |
| DOEN         | 21    | 2          |
| INSA         | 34    | 3          |
| Univ./Instt. | 10    | 1          |
| Industry     | 41    | 4          |
| Misc.        | 90    | 9          |
| Total        | 1048  |            |

31% and 25% respectively. In this Table, the DST comes up in support to the extent of 10% of the supervisors. The share of industry, over the long period of time involved, comes to only 4%.

**5.78** All these Tables indicate that there is insufficient interaction, participation, or even awareness of each other's work in the scientific community in India, at least as far as the institutions of higher education are concerned. Table 5.35 inquired into the question of the sources of present research support which supervisors had received. This Table shows that in the

**Table 5.35 : Research Support  
(Response of Supervisors)  
(Number/Percentage)**

| Category | Valid Response | 1      | 2      | 3    |
|----------|----------------|--------|--------|------|
| CU       | 364            | 146/40 | 212/58 | 6/2  |
| SU       | 466            | 156/33 | 296/64 | 14/3 |
| IIT      | 143            | 72/50  | 53/44  | 8/6  |
| IISc     | 53             | 20/38  | 26/49  | 7/13 |
| Total    | 1026           | 394/38 | 597/58 | 35/3 |

1 – From own institution

2 – From research agency

3 – From industry

Note: Valid Response is more because Supervisors filled in more than one alternative.



Central and the State universities 2% to 3% of the supervisors get support for research from the various research agencies. The IITs and the IISc seem to have, a smaller share in their total research activity coming from research agencies. 40% of the supervisors from Central universities, 33% from State universities, 50% from IITs and 38% from the IISc report that they only get support from their own institutions. Since, the universities particularly do not have much of a research fund at their disposal, it seems that a large number of supervisors are just not receiving any support for their research and they are carrying on with what can be spared from the general support for laboratory work and teaching in their institutions.

**5.79** Two other ways of examining the interaction between the institutions of higher education and research and the outside system are possible, by (1) studying the sponsorship of Fellowships in the universities, and (2) studying the participation of scholars in seminars sponsored by a variety of national agencies. Table 5.36 represents the distribution of Fellowships. According to this study only 77% of the holders have Fellowships of any kind, 23% being unpaid. The Table has been compiled from information provided by scholars. It shows that the CSIR has the highest share, i.e. 31% of the Fellowships in the institutions, and the UGC comes next with 27%. The UGC's share in the Fellowships in the Central and the State universities is at par with that of the CSIR, but the former does not sponsor Fellowships at the IITs. The next highest number of Fellowships are those which the universities or institutions themselves have sponsored. Such Fellowships are 61% amongst IIT scholars, and 50% at the IISc, but as a whole, the share of such sponsorship is only 23%. Furthermore, it is known that the institutional Fellowships are often of a smaller amount of stipend. Among the other agencies, only the Department of Science and Technology figures with 6% of the sample scholars. It is notable that the share of industry is practically

**Table 5.36 : Sponsoring Agency  
(Scholars' Response in Percentage)**

| Agency       | Total | CU | SU | IIT | IISc |
|--------------|-------|----|----|-----|------|
| UGC          | 27    | 34 | 35 | 3   | 17   |
| DST          | 6     | 7  | 7  | 4   | 1    |
| CSIR         | 31    | 35 | 33 | 23  | 19   |
| DAE          | 1     | 1  | 2  | 3   | —    |
| DOE          | 1     | 1  | —  | 1   | —    |
| ICMR         | 2     | 2  | 3  | —   | —    |
| ICAR         | 1     | 2  | 1  | —   | —    |
| State Govt   | 1     | 1  | 2  | —   | —    |
| DOEN         | 2     | 4  | 1  | —   | —    |
| INSA         | —     | —  | —  | —   | —    |
| Univ./Instt. | 23    | 7  | 9  | 61  | 50   |
| Industry     | 1     | 1  | —  | —   | —    |
| Misc.        | 5     | 5  | 6  | 4   | 1    |
| Total        | 77    | 74 | 68 | 95  | 96   |

nil, only six scholars among 2074 claim to be sponsored by industry. "Miscellaneous" category represents various privately sponsored Fellowships.

**5.80** The scholars were asked to specify the state or national seminars, along with the years in which they attended such seminars. The analysis of the data was quite complex because some of the responding scholars had been in the system only one year, and some had been two or more years, ranging up to 6 or 7 years. Those who were recently registered for research would not be attending many seminars whereas those who had been research scholars for a number of years would have the chance to attend many seminars. Table 5.37, as provided, shows in its last row, the number and percentage of those scholars who made no entry at all for this question indicating that they attended no such seminars. This number, on the whole, is 59%, but it is the highest, that is 66%, for the Central universities. It would appear that in any one year only about 25% scholars, at best, attend seminars. It would

**Table 5.37 : Seminars**  
(Percentage Response of the Scholars)

| Year of Registration | Total | CU | SU | IIT | IISc |
|----------------------|-------|----|----|-----|------|
| First Year           | 21    | 17 | 23 | 22  | 21   |
| Second Year          | 25    | 22 | 28 | 27  | 23   |
| Third Year           | 21    | 18 | 20 | 28  | 21   |
| Fourth Year          | 16    | 15 | 15 | 19  | 22   |
| Fifth Year           | 7     | 8  | 7  | 28  | 1    |
| Sixth Year           | 3     | 3  | 3  | 3   | 5    |
| No Seminars          | 59    | 66 | 54 | 59  | 55   |

also appear that after the 3rd year of being enrolled as a scholar, the attending of state or national seminars diminishes sharply. This may be because in many cases, research is practically complete and the scholars may be engaged in writing up their theses. Many of the scholars may have attended seminars repeatedly because the contingency grants provided to UGC or CSIR scholars allow travel to seminars to be paid out of such funds. On the other hand, scholars without Fellowships (23%) perhaps could not afford to attend such seminars. Even taking all such cases into account, 60% scholars have not attended seminars at all, and this seems to be a considerable handicap in scientific communication, leading to lack of knowledge of latest developments and trends of thought.

## Quality of Theses

**5.81** Finally, at the end of all of the various processes, the question is, what is the quality of research produced? Supervisors were asked their opinion regarding the quality of research on the basis of the Ph.D. theses they have

**Table 5.38 : Quality of Research  
(Perception of Supervisors)  
(Number/Percentage)**

| Category                                                                | Valid Reply | No Reply | 1      | 2      | 3      | 4      | 5    |
|-------------------------------------------------------------------------|-------------|----------|--------|--------|--------|--------|------|
| <b>(a) Made real intellectual contribution to knowledge</b>             |             |          |        |        |        |        |      |
| CU                                                                      | 218         | 89/29    | 91/42  | 87/40  | 12/6   | 13/6   | 15/7 |
| SU                                                                      | 303         | 89/23    | 112/37 | 114/38 | 45/15  | 22/7   | 10/3 |
| IIT                                                                     | 89          | 5/5      | 23/26  | 48/54  | 9/10   | 7/8    | 2/2  |
| IISc                                                                    | 30          | 4/12     | 9/30   | 11/37  | 9/30   | 1/3    | —    |
| Total                                                                   | 640         | 189/23   | 235/37 | 260/41 | 75/12  | 43/7   | 27/4 |
| <b>(b) Made serious critical evaluation of existing knowledge</b>       |             |          |        |        |        |        |      |
| CU                                                                      | 220         | 87/28    | 39/18  | 86/39  | 47/21  | 28/13  | 20/9 |
| SU                                                                      | 297         | 95/24    | 52/18  | 125/42 | 77/26  | 30/10  | 13/4 |
| IIT                                                                     | 87          | 7/21     | 15/17  | 42/48  | 22/25  | 8/9    | —    |
| IISc                                                                    | 28          | 6/18     | 4/14   | 10/36  | 7/25   | 7/25   | —    |
| Total                                                                   | 632         | 197/24   | 110/17 | 263/42 | 153/24 | 73/12  | 33/5 |
| <b>(c) Made routine repetitive study of phenomenon by known methods</b> |             |          |        |        |        |        |      |
| CU                                                                      | 215         | 92/30    | 36/17  | 57/26  | 58/27  | 58/27  | 6/3  |
| SU                                                                      | 302         | 90/23    | 46/15  | 67/22  | 77/25  | 85/28  | 27/9 |
| IIT                                                                     | 91          | 3/9      | 14/15  | 23/25  | 21/23  | 30/33  | 3/3  |
| IISc                                                                    | 30          | 4/12     | 4/13   | 7/23   | 6/20   | 13/14  | —    |
| Total                                                                   | 638         | 191/23   | 100/16 | 154/24 | 162/25 | 186/29 | 36/6 |
| <b>(d) Study of known variables by new methods</b>                      |             |          |        |        |        |        |      |
| CU                                                                      | 200         | 107/35   | 64/32  | 78/39  | 33/17  | 14/7   | 11/5 |
| SU                                                                      | 272         | 120/31   | 104/38 | 91/33  | 40/15  | 25/9   | 12/4 |
| IIT                                                                     | 83          | 11/32    | 25/30  | 32/39  | 15/18  | 9/11   | 2/2  |
| IISc                                                                    | 28          | 6/18     | 9/32   | 11/39  | 6/21   | 2/7    | —    |
| Total                                                                   | 583         | 246/30   | 202/35 | 212/36 | 94/16  | 50/9   | 25/4 |

1 – Hardly any

2 – A few

3 – Quite a number

4 – Most

5 – All

examined in their career, and the classification was to be in terms of: (1) made real intellectual/creative contribution to knowledge (2) made serious critical evaluation of existing knowledge (3) made routine/repetitive study of phenomenon by known methods (4) made study of known variables by new methods. The scale was (1) hardly any, (2) a few, (3) quite a number, (4) most, and (5) all. It may be remembered that this response of supervisors



is based on their examining of 8981 theses ! Table 5.38 is a result of the responses.

**5.82** On the question whether the theses examined over a long period of time, made intellectual or creative contribution to knowledge, nearly 40% supervisors from the State and Central universities say hardly any, and another 40% say only a few. In the IITs it is 26% and 54% which also adds up to 80%. Only at the IISc the response is 30% and 37%, that is, a total of 67% people say that they found hardly any or a few theses in this category. If we examine the response “most” and “all” then the Central universities and the State universities stand at 13% and 10% respectively. The IIT supervisors also provide 10%. The IISc supervisors, only to the extent of 3%, say that most or all of the theses had this quality. The over all indication is that, perhaps, no more than 20% theses in the main institutions could be in this category.

**5.83** For the phrase, “made serious critical evaluation of existing knowledge”, the situation is slightly better. Nearly 60% of all supervisors give the opinion that hardly any or a few theses ever examined by them could be put in this category. 50% of supervisors from the IISc are also of the same opinion. At the other end of the spectrum, for “most” and “all” taken together, we find that the supervisors from the various institutions are in this order: 25% from IISc, 22% from Central universities, 14% from State universities and 9% from IITs. A substantial percentage of supervisors, which is more than 20% have the opinion that quite a number of theses could belong in this category. Perhaps, it would not be far off the point if it is taken that something like 30% of the theses may be in this category. A notable point is that the questions about creative contribution and critical studies were independent queries and there could be overlap in the responses of the two questions.

**5.84** When the question was asked about the theses representing routine/ repetitive study of phenomenon by known methods, one finds from the Table that about 60% of the theses fall in this category. Finally, the question was whether the theses examined by the supervisors made studies of known variables by new methods. We find from the response, a uniform 70% opinion that hardly any or just a few theses are in this category. On the other hand those, who say that “most” or “all” of the theses are in this category, are a small 13% from the main institutions and 70% from the IISc. Taking the response to this question and to the question just above, together, it appears that even a use of new methods of measurements is not so common. It strengthens the over all feeling that 60% to 70% of the theses must be of a very routine kind using conventional methods to verify phenomena or properties, etc.

## CHAPTER VI

# The Main Findings and the Action Points that Arise

**6.01** It is intended in this Chapter to take stock of the situation through the findings that have been reported in the earlier Chapters. This will make it possible to precisely indentify what actions are needed to improve the situation.

**6.02** In the very large system of research in the universities and the IITs, it is inevitable that one would find a mixture of good and bad, sometimes it is very difficult to draw the line between the two, or to say how much of what is bad could be tolerated. There are no a priori norms. A similar study conducted elsewhere and particularly in countries where scientific research is known to be strong and well established is not available for comparison. Hence some arbitrariness is bound to creep in while arriving at a judgement about the prevailing conditions in India. There may be those who have an attitude of complacence, who may think that whatever conditions of research may be prevailing in the country, it is best to harp on the positive features. There could be an argument that the culture of research has not taken root, and the prevailing practices are but a part of the general ethos in our society. However, an unsparing attitude towards shortcomings and deficiencies is necessary in order to sharply focus on what has to be done to improve the situation. This is believed to be a scientific approach to the problem, based on the conviction that remedial steps can be found for every failing and, they should be found, so as to make scientific research play its expected role in future development.

**6.03** An assessment of the general atmosphere and spirit prevailing in the research laboratories was made through a question asked both to the supervisors and scholars. Their response in terms of "innovative" and "exciting", "creative" and "positive", "dull" and "unexciting" and "mechanical" and "discouraging" is shown in Table 6.01. Its a reassuring feature that the supervisors and the scholars have a very similar response.

**Table 6.01 : General Atmosphere of Laboratories  
(Percentage Response of Supervisors/Scholars)**

| Category | Innovative & Optimistic | Creative & Positive | Dull & Unexciting | Mechanical & Discouraging |
|----------|-------------------------|---------------------|-------------------|---------------------------|
| CU       | 16/11                   | 57/65               | 19/14             | 8/10                      |
| SU       | 16/14                   | 56/64               | 17/12             | 10/10                     |
| IIT      | 21/12                   | 58/57               | 16/17             | 5/15                      |
| Total    | 17/13                   | 58/64               | 17/13             | 9/10                      |

The variation of the perception from innovative to mechanical is also similar for the three sets of institutions. The fact that about 75% of the perceptions are on the good side has already been commented on.

**6.04** A recall of Table 4.07 representing scholars' perception with regard to quality of research guidance also points in the same direction. 70% of the scholars perceive the guidance to be excellent or good. So, it seems that 25% of the laboratories do not evoke a positive response and 30% of the supervision does not evoke appreciation.

**6.05** In Table 5.38, the supervisors' response about the quality of theses they have examined has been reported. It is worthwhile to recall the data as Table 6.02. This response, based on close to nine thousand theses, says that

**Table 6.02 : Quality of Theses  
(Response of the Supervisors)  
(Number/Percentage)**

| Category                                                           | Hardly any/A Few | Quite a Number | Most/All |
|--------------------------------------------------------------------|------------------|----------------|----------|
| <b>(a) Real intellectual contribution to knowledge</b>             |                  |                |          |
| CU                                                                 | 178/82           | 12/6           | 28/13    |
| SU                                                                 | 226/75           | 45/15          | 32/10    |
| IIT                                                                | 71/80            | 9/10           | 9/11     |
| IISc                                                               | 20/67            | 9/30           | 1/3      |
| Total                                                              | 495/78           | 75/12          | 70/11    |
| <b>(b) Serious critical evaluation of existing knowledge</b>       |                  |                |          |
| CU                                                                 | 125/57           | 47/21          | 48/21    |
| SU                                                                 | 177/60           | 77/26          | 43/14    |
| IIT                                                                | 57/65            | 22/25          | 8/9      |
| IISc                                                               | 14/50            | 7/25           | 7/25     |
| Total                                                              | 373/59           | 153/24         | 106/17   |
| <b>(c) Routine Repetitive study of phenomenon by known methods</b> |                  |                |          |
| CU                                                                 | 93/43            | 58/27          | 64/30    |
| SU                                                                 | 113/37           | 77/25          | 112/37   |
| IIT                                                                | 37/40            | 21/23          | 33/36    |
| IISc                                                               | 11/36            | 6/20           | 13/43    |
| Total                                                              | 254/40           | 162/25         | 222/35   |
| <b>(d) Study of known variables by new methods</b>                 |                  |                |          |
| CU                                                                 | 142/71           | 33/17          | 25/12    |
| SU                                                                 | 195/71           | 40/15          | 37/13    |
| IIT                                                                | 57/69            | 15/18          | 11/13    |
| IISc                                                               | 20/71            | 6/21           | 2/7      |
| Total                                                              | 414/71           | 94/16          | 75/13    |



78% supervisors find hardly any or a few theses that may have made real intellectual contribution. And similarly, 60% say hardly any or a few may have made serious critical evaluation of the existing knowledge. 60% supervisors say that quite a number, most, or all theses made routine repetitive study of phenomena by known methods. One can roughly estimate that about 30% of the theses are indeed good.

**6.06** These findings about the general spirit and atmosphere, and perception of the quality of guidance on the one hand, and of the quality of theses, on the other, are somewhat divergent. One explanation can be that even when the department has a positive atmosphere, the research actually done could often be of indifferent quality due to a variety of factors, for example limitations of equipment or indifferent attitude of supervisors towards excellence in research. Another explanation which has been advanced earlier is that general opinions, say about guidance, could even be a bit favourable, even when specific queries reveal that supervisors do not give enough time to scholars or do not participate in experimental work, or do not check or verify the data, etc. In such cases, the general opinion does not have to be taken on face value, but it has to be toned down in the light of the specific observations about one or another factor.

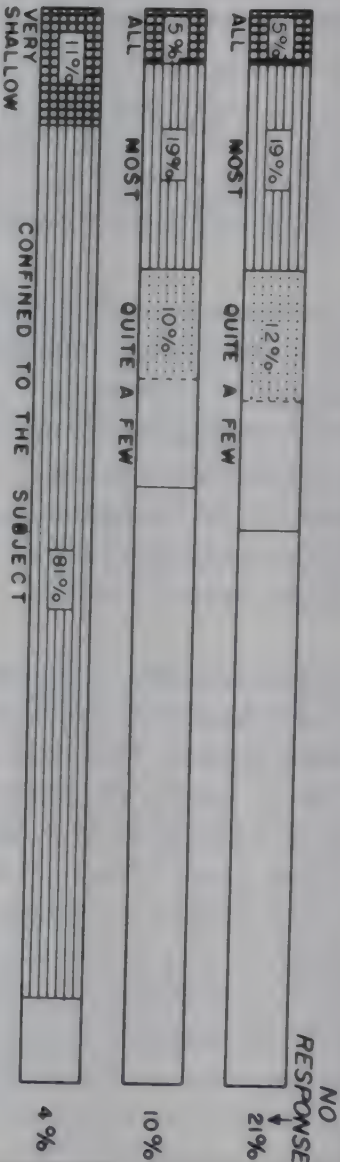
**6.07** A further point which has bearing on this aspect is that the scholars were asked about the running of their research unit/department in terms of "encouraging", "frustrating" and "callous" (ref. Table 5.08), and 39% responded by calling the running as frustrating-callous. In the light of this divergence of opinion, the response on general atmosphere and general quality of guidance has to be moderated by other factors. It would perhaps be a more balanced assessment if half the departments and supervision of research is taken to be upto the mark.

**6.08** A recapitulation of earlier Tables about scholars would throw some light on their academic performance in research, and on attitudinal and motivational aspects. This data is presented in a new strip chart, as Fig.6.1 which shows a profile sketched by supervisors: 1/3rd of the scholars have considerable deficiency in writing scientific reports and comprehending scientific literature, 1/3rd of them have weak foundation in the subject concerned and 90% of them have shallow knowledge and knowledge confined to the subject. If considerable deficiency in experimental skills is also remembered, it becomes clear that the educational attainment and academic preparation for research is highly inadequate. Since a large number of the scholars come from academically poor family and institutional background, it is obvious that they need a Master's degree programme which is designed to overcome these deficiencies.

# PERCEPTION OF SUPERVISORS ABOUT SCHOLARS

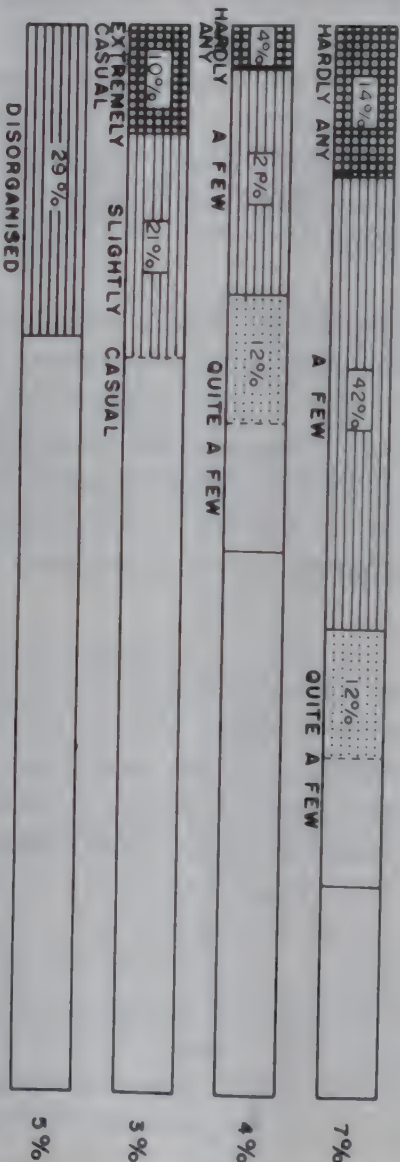
## A. ACADEMIC ASPECTS

- 1. POOR IN ABILITY TO WRITE OR COMPREHEND SCIENTIFIC REPORTS
- 2. WEAK FOUNDATION BUT WILLING TO LEARN.
- 3. DEPTH OF KNOWLEDGE.



## B. ATTITUDINAL ASPECTS

- 1. IMAGINATIVE AND ENTHUSIASTIC
- 2. SINCERE AND HARD WORKING
- 3. ATTITUDE TOWARDS RESEARCH
- 4. WORKING STYLE



NOTE: 50% OF "OUTIE A FEW" IS COUNTED AS NEGATIVE RESPONSE.

Fig. 6.1



**6.09** The chart in Fig.6.1 also shows that according to the supervisors, half of the total number of scholars lack imagination and enthusiasm, roughly the same percentage has either an extremely or slightly casual attitude towards research, and a third of the number is disorganized in their style of work. These factors are, again, related to poor training, loose organisation of research and important societal factors connected with employment, career opportunities and possible motivation based on utilization of scientific research for public good. Although it may appear difficult, but the situation in this regard can also be improved by suitable policy decisions, and even ordinary practical steps.

**6.10** On the whole, it appears that the best talent is not generally attracted to research, and those who are obliged to get into this stream are one of its major weaknesses.

**6.11** As far as the supervisors are concerned they are responsible for establishing the procedures and practices which directly affect the research work in the laboratories. This part of the supervisors' role will be examined a little later, but, another strip chart which is presented as Fig.6.2, shows the perception of the scholars about the supervisors in certain very important respects. This chart shows that 34% of the supervisors are not perceived to be up-to-date in their knowledge, a similar percentage is said not to be devoting enough time to the scholars. A percentage so high as 44 is reported by scholars not to be actually participating in the research activity of the scholars. 35% of the supervisors, it is claimed, do not check the data for its authenticity. 38% of the scholars say that supervisors do not give generous credit to the ideas originated by the scholars. As it has been said earlier, in the absence of supervisor profiles from advanced countries, comparison is not possible. But, when more than one third of supervisors seem to have low academic credibility in the eyes of their own scholars, it should be a matter of great concern to the entire community of supervisors.

**6.12** The role of the supervisors in the main processes which are related to evaluation of students or scholars and to the recognition of merit in order to promote good work and provide personal encouragement is crucial. Unfortunately, this is where one finds the supervisors most deficient in discharging their responsibility. Examination results of the universities have gone down in credibility so much so that national examinations have had to be superimposed on the evaluation system in order to determine the relative merit of students. The results of these examinations, particularly the UGC/CSIR examination, which is itself set by university professors, have been quoted earlier to show that less than 1% of the scholars getting 60% marks in the university examinations are able to score 60% marks in the



# PERCEPTION OF SCHOLARS ABOUT SUPERVISORS

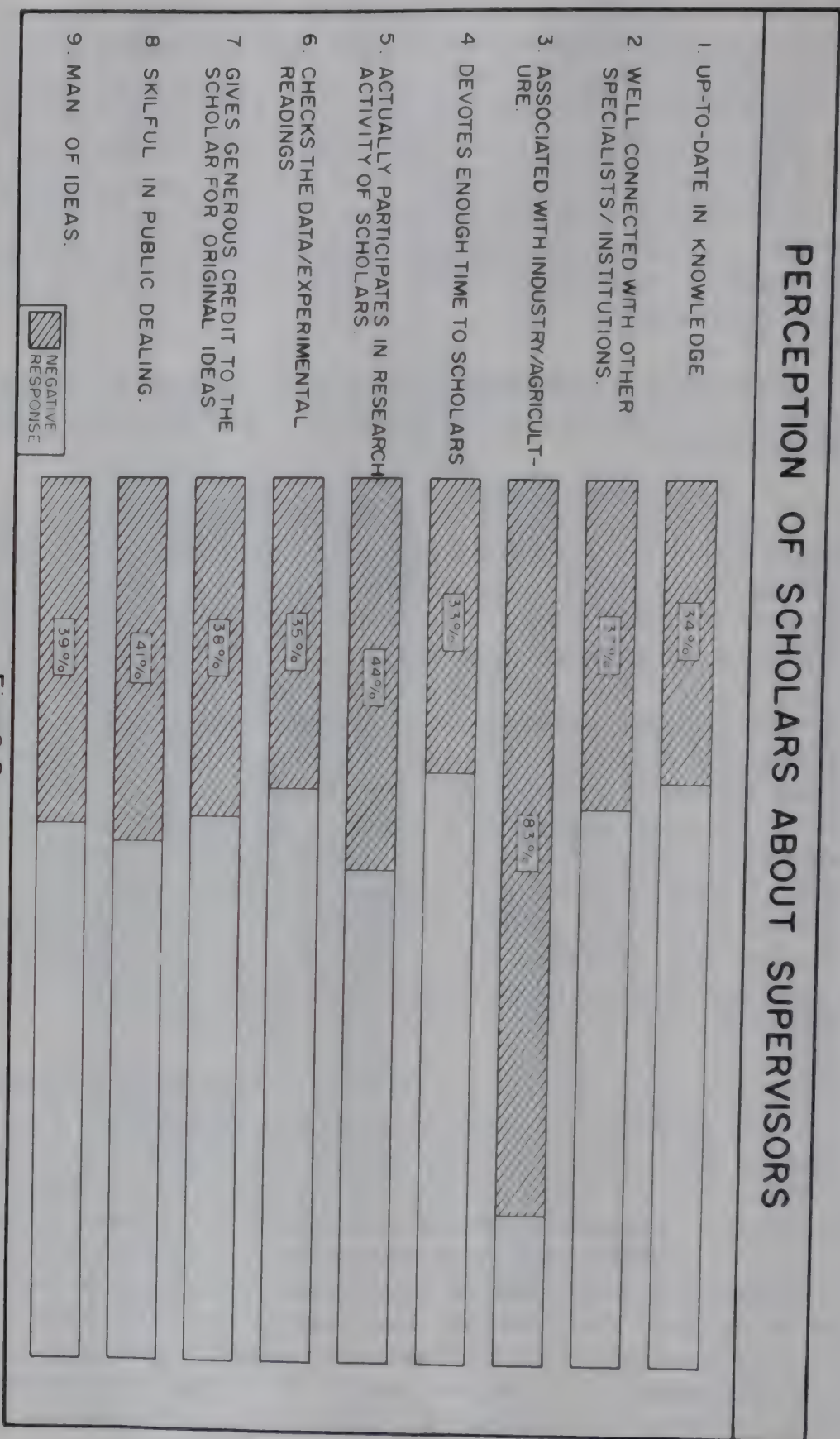


Fig. 6.2

national examination. The highly inflated marks in practical examinations have reduced the usefulness of laboratory work and the learning of laboratory skills. It has been mentioned how in the evaluation of theses, even when the reports are very critical, degrees are awarded, not in a few cases here and there, but consistently in all the institutions to a fairly large extent. A thesis which is fit to be rejected, is rejected in practice by only 12% or so examiners, whereas about 40% of the supervisors would find one reason or another to allow a degree to be awarded on the basis of such a thesis. This value system in which intrinsic merit of a piece of work is not determined but generosity towards the scholars, or friendship with fellow supervisors, and perhaps, considerations of other irrelevant kind play a big part, is extremely detrimental to maintenance of high standards in research.

**6.13** In situations other than examinations too, responses of scholars have been presented (Table 5.14) with regard to recognition and encouragement in accordance with merit. Table 6.03 is an abbreviated version of the earlier

**Table 6.03 : Due Recognition and Encouragement to Scholars  
(Response of Scholars)  
(Number/Percentage)**

| Factors              | Never  | Occasional |
|----------------------|--------|------------|
| Sex                  | 562/30 | 421/23     |
| Caste                | 598/33 | 338/19     |
| Religion             | 716/40 | 269/15     |
| Domicile             | 604/34 | 394/22     |
| Non-academic Efforts | 631/36 | 478/27     |

Table. It shows the magnitude of favouritism or prejudice which is employed in a very important academic function. Almost 40% of the scholars report departure from intellectual integrity on the basis of domicile, and a variety of non academic efforts which a scholar has to make. The corruption of sound academic values to such a large extent must be causing tremendous frustration, especially among the most meritorious of the scholars, as it must be damaging the atmosphere of confidence and trust prevailing in the laboratories. Supervisors in India, having been born and brought up in a welter of prejudices, may take it lightly, but failing to recognise merit and excellence on such a large scale must be wrecking havoc to scientific research.

**6.14** The question of prevalence of malpractices of various kinds has been investigated and reported earlier in Table 5.15, but Table 6.04 summarises it for occasional + frequent response. The Table shows that these reprehensible practices are not at all rare, but they are quite occasionally resorted to in all



**Table 6.04 : Occasional/Frequent Malpractices  
(Perception of Scholars)  
(Number/Percentage)**

| Category | 1      | 2      | 3      | 4      | 5      | 6      |
|----------|--------|--------|--------|--------|--------|--------|
| CU       | 248/44 | 170/31 | 180/32 | 352/64 | 202/37 | 126/24 |
| SU       | 290/37 | 178/24 | 179/24 | 299/50 | 201/27 | 142/21 |
| IIT      | 74/32  | 37/17  | 47/22  | 127/56 | 69/26  | 47/21  |
| IISc     | 55/29  | 25/13  | 29/15  | 74/40  | 43/25  | 59/32  |
| Total    | 667/38 | 410/24 | 435/26 | 926/54 | 515/31 | 374/23 |

(1) Manipulation of Data

(2) Forging of Data

(3) Using unacknowledged data from somebody else's work

(4) Appointing specially considerate examiners

(5) Awarding degree in spite of very critical reports of examiners

(6) Making exaggerated/false/premature claims in non-scientific forums and publications

kinds of institutions. The incidence is also high, if it is recalled that lot of scholars (about 20%) were afraid to respond to the question.

**6.15** All these factors underline the value system, which is the cornerstone of good scientific research, and we cannot but admit that they are cultural in nature. The unscientific value system is so widely prevalent in all institutions of higher education under study, that one fears it could be found in other research establishments if we only looked for it. The culture is undoubtedly feudal in nature because judgements are arbitrary and subjective, an act is not judged in itself but according to who does it, and human or humane considerations are more important than such intangible things as academic excellence. Since our society is in the process of transition from a feudal to an industrialised state, all this is understandable but scientists, who should represent the most advanced thinking, falling into out-of-date values and modes of conduct uncharacteristic of science, is certainly unexpected and shocking.

**6.16** It is known, and perhaps, it is true everywhere, that the relationship between a scholar and the supervisor is especially intimate, and the fate of the scholar, to a large extent, is in the hands of the supervisor. The scholar cannot complain, much less protest, and he or she has no option but to fall in line with whatever are the preferences or desires of the supervisor. Change of supervisor is usually not possible simply because the scholar wants it, and in any case, another supervisor would hesitate to enrol the scholar under him when relations with one supervisor have been strained. In this framework, it must be extremely humiliating for scholars to reconcile, and probably that is why research scholars in many institutions have become organised into Associations or Unions.



**6.17** These are matters where the system cannot be corrected either easily or soon. Perhaps, the only way it can be improved is by introspection by the supervisors themselves about their conduct, and their discovering a way of affirming positive scientific values by their own conduct. Certain remedial action could also be provided for, so that at least a gross miscarriage of scientific evaluation could be enquired into and corrected.

**6.18** This investigation has shown many other deficiencies of the research activity for which the supervisors are a determining factor and, therefore, responsible. Table 5.01 has shown that almost 35% of the scholars do not spend the full working hours of a day on research, and more than 20% are away from work for more than 100 days in a year. In the investigation about whether the supervisor gives enough time to his research scholar, summarised in Table 6.05, it is shown that 30 to 40% of supervisors were not able to say

**Table 6.05 : Enough Time Devoted by the Supervisors  
(Perception of the Scholars)  
(Number/Percentage)**

| Category | Yes     | No     |
|----------|---------|--------|
| CU       | 462/69  | 209/39 |
| SU       | 594/68  | 279/32 |
| IIT      | 173/61  | 109/39 |
| IISc     | 150/60  | 97/39  |
| Total    | 1379/66 | 693/33 |

that such a meeting took place either once in a week, once in a fortnight or once in a month. In a large majority of cases, the supervisors met the scholars as and when convenient. Similarly, to another question whether it was a practice in the departments to have a scholar present his work before a seminar, at least, once a year, the supervisors as well the scholars gave the

**Table 6.06 : Regular Presentation of Research Work at least Annually for a Discussion at a  
Departmental Seminar  
(Response of Supervisors/Scholars)**

| Category | Valid Reply<br>(Number) | Yes<br>(Percentages) | No    |
|----------|-------------------------|----------------------|-------|
| CU       | 303/670                 | 19/23                | 81/77 |
| SU       | 337/873                 | 24/38                | 76/62 |
| IIT      | 94/282                  | 63/58                | 37/42 |
| IISc     | 34/247                  | 65/77                | 35/23 |
| Total    | 768/2072                | 29/40                | 71/60 |

answer as shown in Table 6.06. This Table indicates that in the large majority of cases, the scholars never get such an opportunity.

**6.19** All these deficiencies of regularity, discipline in the laboratories, and self-discipline regarding over ambitious enrolment of scholars, are perfectly removable. Only the supervisors have to be conscious of their responsibility in the proper functioning of the research set up.

**6.20** This study has established that nearly 70% of the supervisors are isolated and only about 30% interact in any way with research going on in other institutions. Furthermore, every kind of sharing, reciprocity, cooperation and linkage appear to be very limited, as is the sharing of facilities within departments, between departments of the same institution, and across institutions. It is true that some of these linkages cannot be established unilaterally by supervisors in the universities and the IITs, but then these supervisors have to exert their influence to bring about a higher level of exchange between institutions conducting research. The external agencies, particularly those which are responsible for research on a national level are also to be held responsible for not building linkages and connections between one set of institutions and another. In the present situation, nearly 70% of the scholars have indicated that they are not in contact even with those, who are working on similar problems in other institutions. Participation in State and national seminars is so limited that nearly 60% of the scholars never attend any such seminar (Table 5.36).

**6.21** On the indication provided by this study, it has been found [Table 5.19(a)] that about 30% of the research produced by the universities and the IITs is certainly of good quality. It has further been estimated that nearly 80% of the work is perceived to be either applied or applicable, [Table 5.18(a)]. When these figures are seen in the context of about 3000 research theses submitted and approved every year, we get a huge number of something like 700 theses submitted in the universities and the IITs every year which are undoubtedly of a good quality and which could be of interest to user agencies. But, at the present time, there is no agency that bridges the two systems. This leads to lack of utilisation of even good research that has been undertaken, and consequent disheartenment of the researchers. Undertaking of research in problems relevant to industry or agriculture or to society at large is very important not only from the point of view of its direct results in the field but also because it provides incentives and motivation to the research workers. The national agencies are not fulfilling this task even though its importance has been accepted. A national research council for coordinating and enhancing research in the institutions of higher education was recommended to be set up by Parliament in 1986, but there seems to be no real move to establish it. On the other hand, general pressure for "relevant research" and "thrust area" has resulted in partial distortion of university research system. From whatever quantification this investigation has been



able to make, it appears that about 80% of the research is of applied kind; and basic research has a share in the universities of just about 20%. This imbalance has also to be corrected because, often, trivial research is being done in the name of applied research. Much of this research tends to be mediocre with little creative or intellectual input. While national planning of economic development could throw up significant problems for research, which, by suitable interaction, could be assigned to be taken up by the universities, a very determined effort has to be made to encourage and expand basic research in the universities. Its proportion is very low as compared to what obtains in good institutions abroad.

**6.22** With considerable work that has been reported on the scholars registered in the decade 1975-85 and their progression towards the Ph.D. degree, it is possible to estimate, for the first time, that the drop-out rates are very high. The overall drop-out rate is about 30%, although in a couple of subjects it is higher than 50%. It has been pointed out that this is a tremendous loss and almost 1/3rd of the total money spent on scientific research in the institutions is lost in the process. There are a number of operations connected with evaluation of research, for example, the time spent on actual examination of the theses, the holding of the viva-voce examinations, and processing of reports through various committees in the universities, which could all be curtailed drastically. It is the supervisor who, as a significant manager of university affairs could materially change the situation. The finding of the data that more than 20% of the scholars take an inordinately long time to complete research and thus add to the costs in the system, and reduce its efficiency, also needs special attention to find suitable measures.

**6.23** A few decades ago, there used to be discussions whether scientists should carry out their research entirely for the sake of extending the frontiers of knowledge, or they should be concerned with the requirements of the society around them and undertake work which might have relevance for solving significant problems of social and economic concern. The dominant feeling was that scientists should be concerned with science alone, because it would be a waste of time and energy to indulge in other activities. This was the ivory tower view. The situation seems to have drastically changed, and scientists in all institutions now show a great deal of concern with the application of their work in social and economic development, and in its implications for social and cultural progress. Questionnaires meant for the supervisors as well as the scholars had a question which ran as follows.

**6.24** Which one of the following views represents your way of thinking:  
(a) Scientists should be concerned exclusively with their own work,



- (b) Scientists should be concerned with the application of their work in social and economic development,
- (c) Scientists should be concerned with social, economic and political development because their work is related to all these factors, and
- (d) Scientists should be concerned with all implications of their work and should understand science as an important social and cultural factor.

**6.25** The response to this question is given in Table 6.07(a) for scholars and 6.07(b) for supervisors. The scholars' response is similar from all

**Table 6.07(a) : Involvement of Scientists in Society  
(Perception of the Scholars)  
(Number/Percentage)**

| Category | Valid Reply | No Reply | A     | B      | C     | D       |
|----------|-------------|----------|-------|--------|-------|---------|
| CU       | 646/96      | 24/4     | 45/7  | 194/30 | 49/8  | 358/55  |
| SU       | 793/91      | 80/9     | 53/7  | 258/33 | 53/7  | 429/54  |
| IIT      | 270/96      | 12/4     | 16/6  | 73/27  | 23/9  | 158/59  |
| IISc     | 226/91      | 21/9     | 18/8  | 56/25  | 15/7  | 137/61  |
| Total    | 1935/93     | 137/7    | 132/7 | 581/30 | 140/7 | 1082/56 |

A – Scientists should be concerned exclusively with their own work.

B – Scientists should be concerned with the application of their work in social and economic development.

C – Scientists should be concerned with social, economic and political development because their work is related to all these factors.

D – Scientists should be concerned with all implications of their work and should understand science as an important social and cultural factor.

**Table 6.07(b) : Involvement of Scientists in Society  
(Perception of the Supervisors)  
(Number/Percentage)**

| Category | Valid Reply | No Reply | A      | B      | C    | D      |
|----------|-------------|----------|--------|--------|------|--------|
| CU       | 303         | 4/1      | 52/17  | 97/32  | 4/1  | 150/50 |
| SU       | 337         | 55/14    | 64/19  | 103/31 | 4/1  | 166/49 |
| IIT      | 95          | 1/1      | 18/19  | 21/22  | 4/4  | 52/55  |
| IISc     | 34          | –        | 12/35  | 6/18   | –    | 16/47  |
| Total    | 769         | 60/7     | 146/19 | 227/29 | 12/2 | 384/50 |

Note: A, B, C & D Read as in Table 6.07 (a)

institutions, and only 7% of them are now of the view that scientists should be exclusively concerned with their own work. 30% of them have the opinion that scientists should be concerned with the application of their work in social and economic development, and 56% have given the view that scientists should be concerned with all implications of their work. It is notable that only 7% have responded that they should be concerned with social economic as well as political development, because their work is related to all these factors. Of the 93% of the responding scholars, 86% have given an opinion in favour of the larger social economic and cultural factors which must

attract the attention of scientists, only when the word “political” is added, a hesitation is discernable.

**6.26** As far as the supervisors are concerned, a much larger percentage (19%) is for exclusive concern of scientists for their own work, this opinion is even stronger at the IISc, where 36% of the supervisors are of this view. The percentage of those who would have scientists to concern themselves with the application of their work in social and economic development is 29%, which is very similar to the figure in the case of scholars. But in this case, strangely, a lower percentage of the IIT and IISc supervisors have responded positively. The response to the question about scientists concerning themselves with all implications of their work is again very similar to the scholars’ response, 50% of supervisors as compared to 56% of scholars. On the question in which the word “political” was included, the supervisors are much more cautious and only 1% of them have favoured this opinion. On the whole, 77% of the responding supervisors are not in favour of science for the sake of science but they would like to see science related to social, economic and other needs and concerns of the society.

**6.27** Since it is well known that the major economic decisions in any society or country are basically political, arising from an interplay of national as well as international vested interests, reluctance of scientists to see this, or their naivety in this connection is quite remarkable. Scientists have no difficulty in seeing that their work can influence economic and social development, but they do not realise that scientific intervention can take place only when relevant political decisions regarding directions of growth and who is to benefit from it, are clearly taken. For example, if the intention of policy is to provide durable consumer goods to a small section of population, import of such goods or their manufacture under licence can take place but then, technological and scientific development within the country will not be pressed and scientific research would also become a luxury.

**6.28** Brain-drain is a problem for all the developing countries and there are lots of studies about it. There is a lot of data which has been collected recently on brain-drain from India. This problem is more acute where more competent work is being done, particularly in emerging fields of scientific and technological interest. It is found that scholars doing their Master’s degree or Ph.D. in subjects like bio-technology, micro-electronics, or computer sciences, etc., are much in demand overseas, just like competent engineers and doctors. Since we do not provide for ready employment even for these highly qualified people, on whose training the country spends huge amount of money, or at best only some people can obtain employment after a period of waiting, there is a tendency to migrate and seek opportunities in other



countries, particularly in the United States. Brain-drain even to the extent of 90% of qualified people from certain fields of study and certain prestigious institutions has distorted the whole approach to the selection of a problem for research in these institutions. Problems are often selected with an eye to their usefulness in going abroad. Government and Policy makers, however, have neglected the question to such an extent that we do not have any authentic information on either yearly or cumulative migration of talent from the country. The recent work which has been done by the two IITs at Bombay and Madras is remarkable in the sense that the reasons behind migration of talent have been explored. One of the reasons which has emerged is lack of opportunity to undertake challenging work related to social and economic development of the country.

**6.29** There is a great scope in this field for a new policy to be adopted which would, on the one hand, design and plan the provision of the most essential needs of our vast population in the matter of food, health, shelter, education and culture, and on the other hand, to identify scientific problems which would have to be solved in order to satisfy these needs on such a vast scale, in the most expeditious and economical way. The possibility of making positive contributions to scientific research related to such social and economic development would probably generate enthusiasm and excitement, and it would augment creative spirit of the scientific community. It could attract talent to study and research in science, and thereby raise its quality.

**6.30** One of the remarkable facts, which has emerged from this investigation, is that in the nature of its scholars and supervisors, and in respect of their perception of each other, and the operation of the value system, and in many other factors, there is a great similarity between all the institutions. Though the Indian Institute of Science at Bangalore and the IITs are definitely better from the point of view of organisation and discipline, in most other respects there is common character among all the institutions. High quality is also evenly distributed among these institutions. The very considerable differences in the financial inputs to these various institutions have not been able to establish what could be called a hierarchy of excellence among them. The State universities which are rather poorly off, the Central universities which are much better off and the IITs which are even said to be affluent, have been performing at very much the same level on all the measures that have been within the scope of this study.

**6.31** The implication is very strong that, on the one hand, more input is needed to strengthen the various facilities in all kinds of institutions and in particular to properly improve and organise various services which are essential for the working of the research set up, but on the other hand,



financial input alone is not going to improve the performance radically. Table 6.08(a) and Table 6.08(b) are a summary of an earlier Table indicating

**Table 6.08 (a) : Poor/Very Poor Facilities  
(Response of Scholars)  
(Number/Percentage)**

| Category | Library | Documentation | Equipment | Purchase of Consumables | Computer |
|----------|---------|---------------|-----------|-------------------------|----------|
| CU       | 149/23  | 244/40        | 175/26    | 185/29                  | 334/54   |
| SU       | 320/37  | 411/52        | 302/36    | 266/32                  | 452/51   |
| IIT      | 39/14   | 65/26         | 47/18     | 52/20                   | 25/9     |
| IISc     | 23/10   | 32/14         | 19/8      | 20/9                    | 21/9     |
| Total    | 532/26  | 753/40        | 543/28    | 523/26                  | 832/45   |

**Table 6.08(b) : Poor/Very Poor Services  
(Response of Scholars)  
(Number/Percentage)**

| Category | Maintenance | Management/<br>Coordination | Laboratory Assistance | General Team Work |
|----------|-------------|-----------------------------|-----------------------|-------------------|
| CU       | 298/45      | 275/53                      | 341/54                | 131/21            |
| SU       | 386/45      | 333/40                      | 414/51                | 155/18            |
| IIT      | 106/40      | 97/36                       | 102/40                | 65/24             |
| IISc     | 54/24       | 42/18                       | 61/27                 | 39/17             |
| Total    | 844/42      | 747/37                      | 918/47                | 341/17            |

the percentage of scholars who have felt the facilities and services in various institutions to be either very poor or poor. This Table speaks quite clearly about the urgent need for material improvement. But the non-financial input of organisation, inculcation of discipline and a change-over to liberal and scientific values, rectification in the climate of work, etc., must accompany financial inputs to cause distinct improvements to take place.

**6.32** The point is illustrated by an interesting example. The UGC and the Planning Commission have cooperated to set up a system by which some departments of the universities are selected for fairly large financial support to improve all kinds of teaching and research facilities. These departments are called COSIST departments. The data which has been collected in the course of the present study has been tabulated for the COSIST and NON-COSIST departments, and for comparison, the IITs' data has been included

to construct a few Tables. Table 6.09 (a) is a comparison of COSIST and NON-COSIST departments in regard to facilities and shows that there has been marked improvement in favour of the COSIST departments where the “very poor” and “poor” perceptions are much lower than in the NON-COSIST departments, and “good” and “excellent” are much higher. Table 6.09(b) compares the position in respect of sharing of facilities, contact among scholars and awareness in respect of an important national service. This table shows that COSIST departments are as good or bad as any other, including IITs. Table 6.10 lists human and organisation related factors. This table shows that there is hardly any difference between the COSIST and NON-COSIST departments. If at all, research guidance and laboratory assistance has been judged to be excellent by a smaller proportion of scholars.

**Table 6.09(a) : Facilities in Research**  
(Response of Scholars)  
(Number/Percentage)

|                                     | Valid Reply | No Reply | Very Poor | Poor   | Fair   | Good   | Excellent |
|-------------------------------------|-------------|----------|-----------|--------|--------|--------|-----------|
| <b>(i) Library</b>                  |             |          |           |        |        |        |           |
| COSIST                              | 914/97      | 24/3     | 64/7      | 123/13 | 262/29 | 368/40 | 97/11     |
| NON-COSIST                          | 837/98      | 15/2     | 126/15    | 180/22 | 287/34 | 197/24 | 47/6      |
| IIT                                 | 275/97      | 7/3      | 12/4      | 27/10  | 59/21  | 136/49 | 41/15     |
| Total                               | 2026/98     | 46/2     | 202/10    | 330/16 | 608/30 | 701/35 | 185/9     |
| <b>(ii) Computer</b>                |             |          |           |        |        |        |           |
| COSIST                              | 859/92      | 79/8     | 227/26    | 101/12 | 193/22 | 226/26 | 116/14    |
| NON-COSIST                          | 730/86      | 122/14   | 396/54    | 84/12  | 104/14 | 99/14  | 47/6      |
| IIT                                 | 262/93      | 20/7     | 9/3       | 16/6   | 61/23  | 108/41 | 68/26     |
| Total                               | 1851/99     | 221/11   | 632/34    | 201/4  | 358/19 | 429/23 | 231/12    |
| <b>(iii) Equipment</b>              |             |          |           |        |        |        |           |
| COSIST                              | 890/95      | 48/5     | 60/7      | 14/16  | 311/35 | 305/34 | 73/8      |
| NON-COSIST                          | 817/96      | 35/4     | 94/12     | 176/21 | 330/40 | 180/22 | 37/5      |
| IIT                                 | 264/94      | 18/6     | 10/4      | 42/16  | 104/39 | 96/36  | 12/5      |
| Total                               | 1971/95     | 101/5    | 164/8     | 359/18 | 745/38 | 581/29 | 122/6     |
| <b>(iv) Purchase of Consumables</b> |             |          |           |        |        |        |           |
| COSIST                              | 890/95      | 48/5     | 60/7      | 14/16  | 311/35 | 305/34 | 73/8      |
| NON-COSIST                          | 817/96      | 35/4     | 94/12     | 176/21 | 330/40 | 180/22 | 37/5      |
| IIT                                 | 264/94      | 18/6     | 10/4      | 42/16  | 104/39 | 96/36  | 12/5      |
| Total                               | 1971/95     | 101/5    | 164/8     | 359/18 | 745/38 | 581/29 | 122/6     |
| <b>(v) Documentation</b>            |             |          |           |        |        |        |           |
| COSIST                              | 834/89      | 104/11   | 115/4     | 183/22 | 277/33 | 229/27 | 30/4      |
| NON-COSIST                          | 787/92      | 65/8     | 182/23    | 208/26 | 269/34 | 105/13 | 23/3      |
| IIT                                 | 257/91      | 25/9     | 17/7      | 48/19  | 97/38  | 77/30  | 18/7      |
| Total                               | 1878/91     | 194/8    | 314/17    | 439/23 | 643/34 | 411/22 | 71/4      |

**Table 6.09 (b) : Sharing of Facilities amongst Scholars  
(Response of Scholars)  
(Number/Percentage)**

|                                                                                                  | Yes     | No      |
|--------------------------------------------------------------------------------------------------|---------|---------|
| <b>(i) Availability of inter-departmental facilities to all the scholars of the departmental</b> |         |         |
| COSIST                                                                                           | 578/62  | 360/38  |
| NON-COSIST                                                                                       | 475/56  | 377/44  |
| IIT                                                                                              | 174/62  | 108/38  |
| Total                                                                                            | 1227/59 | 845/41  |
| <b>(ii) Inter-departmental/Institutional facilities</b>                                          |         |         |
| COSIST                                                                                           | 321/34  | 617/66  |
| NON-COSIST                                                                                       | 280/33  | 572/67  |
| IIT                                                                                              | 104/48  | 178/63  |
| Total                                                                                            | 705/34  | 1367/66 |
| <b>(iii) Contact with scholars working on similar problem</b>                                    |         |         |
| COSIST                                                                                           | 256/27  | 682/73  |
| NON-COSIST                                                                                       | 288/33  | 585/67  |
| IIT                                                                                              | 66/23   | 195/69  |
| Total                                                                                            | 610/29  | 1462/71 |
| <b>(iv) Awareness of the UGC science information service</b>                                     |         |         |
| COSIST                                                                                           | 433/46  | 505/54  |
| NON-COSIST                                                                                       | 354/42  | 498/58  |
| IIT                                                                                              | 139/49  | 143/51  |
| Total                                                                                            | 926/4   | 1146/55 |

**Table 6.10 : Services/Human Factors in Research  
(Response of scholars)  
(Number/Percentage)**

|                                                        | Valid Reply | No Reply | Very Poor | Poor   | Fair   | Good   | Excellent |
|--------------------------------------------------------|-------------|----------|-----------|--------|--------|--------|-----------|
| <b>(i) Research Guidance</b>                           |             |          |           |        |        |        |           |
| COSIST                                                 | 912/97      | 26/3     | 29/3      | 51/6   | 171/19 | 382/42 | 279/31    |
| NON-COSIST                                             | 842/99      | 10/1     | 26/3      | 36/4   | 143/17 | 338/40 | 299/36    |
| IIT                                                    | 273/96      | 9/3      | 17/6      | 23/8   | 72/26  | 105/38 | 56/21     |
| Total                                                  | 2027/98     | 45/2     | 72/4      | 110/5  | 386/19 | 825/41 | 634/31    |
| <b>(ii) General Team Work &amp; Cooperation</b>        |             |          |           |        |        |        |           |
| COSIST                                                 | 913/97      | 25/3     | 77/8      | 93/10  | 245/27 | 325/36 | 173/19    |
| NON-COSIST                                             | 829/97      | 23/3     | 61/7      | 95/11  | 192/23 | 314/38 | 167/20    |
| IIT                                                    | 275/97      | 11/4     | 25/9      | 40/15  | 78/29  | 90/33  | 38/14     |
| Total                                                  | 2013/97     | 59/3     | 163/8     | 228/11 | 515/26 | 729/36 | 378/19    |
| <b>(iii) Management and Coordination of facilities</b> |             |          |           |        |        |        |           |
| COSIST                                                 | 902/96      | 36/4     | 114/13    | 203/23 | 337/37 | 193/21 | 55/6      |
| NON-COSIST                                             | 816/96      | 36/4     | 118/14    | 215/26 | 263/32 | 183/22 | 37/5      |
| IIT                                                    | 263/93      | 19/7     | 29/11     | 68/26  | 95/36  | 61/23  | 10/4      |
| Total                                                  | 1981/96     | 91/4     | 261/13    | 486/24 | 695/35 | 437/22 | 102/5     |
| <b>(iv) Laboratory Assistance</b>                      |             |          |           |        |        |        |           |
| COSIST                                                 | 886/94      | 52/6     | 188/22    | 224/25 | 247/28 | 176/20 | 51/6      |
| NON-COSIST                                             | 783/92      | 69/8     | 253/32    | 202/26 | 197/25 | 151/19 | 31/19     |
| IIT                                                    | 254/90      | 28/10    | 41/16     | 61/24  | 99/39  | 40/15  | 13/5      |
| Total                                                  | 1923/93     | 149/7    | 431/22    | 487/25 | 543/28 | 367/19 | 95/5      |
| <b>(v) Maintenance</b>                                 |             |          |           |        |        |        |           |
| COSIST                                                 | 909/97      | 29/3     | 126/14    | 224/24 | 332/37 | 187/21 | 42/5      |
| NON-COSIST                                             | 829/97      | 23/3     | 168/20    | 222/27 | 247/30 | 151/18 | 41/5      |
| IIT                                                    | 268/95      | 14/5     | 48/18     | 58/22  | 115/43 | 42/16  | 5/2       |
| Total                                                  | 2006/97     | 66/3     | 342/17    | 502/25 | 694/35 | 380/19 | 88/4      |



**6.33** Therefore, just one more Table is presented showing the scholars' preception of the "level of dedication" to research among fellow workers. Table 6.11 shows that there is hardly a difference between two sets of institutions. The only other evidence of the COSIST departments showing a slightly better standing, but only slightly, is provided through Table 6.12

**Table 6.11 : Level of Dedication to Research amongst Your Fellow Research Workers  
(Scholars' Response)  
(Number/Percentage)**

|            | Valid Reply | No Reply | Very High | High   | Medium | Low   | Very Low |
|------------|-------------|----------|-----------|--------|--------|-------|----------|
| COSIST     | 907/97      | 31/3     | 138/15    | 172/41 | 336/37 | 47/5  | 14/2     |
| NON-COSIST | 817/96      | 35/4     | 114/14    | 330/40 | 315/39 | 48/6  | 10/1     |
| IIT        | 277/98      | 5/2      | 44/16     | 133/48 | 84/30  | 13/5  | 3/1      |
| Total      | 2001/97     | 71/3     | 296/14    | 835/39 | 735/36 | 108/5 | 27/1     |

**Table 6.12 : How Would You Describe the General Atmosphere of Your Laboratory  
(Scholars' Response)  
(Number/Percentage)**

|            | Valid Reply | No Reply | Innovative & Optimistic | Creative & Positive | Dull & Unexciting | Mechanical & Discouraging |
|------------|-------------|----------|-------------------------|---------------------|-------------------|---------------------------|
| COSIST     | 876/93      | 62/7     | 129/15                  | 556/6               | 103/12            | 88/10                     |
| NON-COSIST | 796/93      | 56/7     | 54/7                    | 382/48              | 83/10             | 53/7                      |
| IIT        | 258/91      | 24/9     | 31/2                    | 146/57              | 43/17             | 38/15                     |
| Total      | 1930/93     | 142/7    | 214/11                  | 1084/56             | 229/12            | 179/9                     |

where the general atmosphere of the laboratory is reported on by the scholars. Unfortunately, there is a higher percentage of COSIST departments being perceived as dull and unexciting or mechanical or discouraging than the NON-COSIST departments. But, fortunately, more COSIST departments are perceived to be innovative and optimistic or creative or positive than in the rest of the system. Large inputs of money resulting in better physical facilities can create a brief spell of excitement and hope.

**6.34** The analysis of the UGC/CSIR examination, comparing students from COSIST departments with NON-COSIST departments also shows that in the performance at the national level test, the difference between the two sets of departments is marginal.

## CHAPTER VII

# Academic Conditions and Climate in the Institutions

### Preamble

The research staff of the Project had to visit the universities and the IIT's in order to canvass the questionnaires with the scholars. 26 out of 27 institutions in the sample were visited, for durations of a few days to several days each, depending on the size of the research activity and enrolment. The staff consisting of three young women of approximately the same age and qualifications as the scholars stayed mostly in hostels on the campuses and they visited the departments of science to talk to the faculty and the scholars. They had plenty of opportunity of informal discussions and chats with the young men and women engaged in research, who, because of complete confidence, spoke to the staff with great frankness. Some excerpts of the individual reports, members of the staff wrote soon after the visit to each institution, are presented below because they capture the overall climate and flavour of each place. It is believed that these impressions, along with the other data, would help one to form a more balanced view of the research environment in the institutions. The results of the analysis presented in the earlier chapters were not available when the visits were made.

The reports are basically in original words, and in making the excerpts care has been taken to preserve the overall balance between the good and the not so good in each report. For the sake of brevity, parts of reports on two IIT's (out of five), three Central universities (out of six) and five State universities (out of 16) are reproduced. Names of the institutions have been left out for obvious reasons.

### 1. INSTITUTION "A", AN IIT

#### Research Scholars Forum

**7.1.01** First thing that strikes our attention as soon as we enter the Campus are large posters stuck on the trees, exhibiting the demands of Research Forum

for betterment in the existing facilities. “Nurture Research Culture”, “Top Priority for Research”, “We want hike in Scholarship” these are a few slogans that are displayed at prominent places. The demands of research students were for enhancement of scholarships and contingent grants, and for prompt technical services and maintenance.

**7.1.02** In sharp contrast to a Central university where the environment is highly charged with politics throughout the year and the inmates sport the typical intellectual comrade looks, with a Khadi bag and Kurta, or unlike another Central university, where the aspiring prospective student leaders, pick up any small issue and organise a hunger strike, sometimes before the student elections, the members of Research Forum genuinely seem to be working for the improvement of their working conditions.

**7.1.03** A cross-section of scholars who are strongly involved with the Research Forum activities asserted that all kinds of malpractices that are prevalent in the universities elsewhere in India, also exist in the IIT. They have no say in the selection of research topic assigned to them. Their friends have sometimes committed intellectual suicide by dropping out of research after having worked for 4-5 years, and the tradition of supervisor's name always appearing as the first author is still being followed in several departments. Following points emerged out of our conversation with the “hard core” group of the Research Forum:

1. Teachers have fleeting interests. They get involved with whatever is new and in vogue abroad. They make the scholars work on it for 4-5 years and then again switch over to something new which catches their fancy.

2. Collaborations do exist between supervisors and industries but the scholar is not a part of it. He is made to work like a paid labourer whose job finishes as soon as the project ends. As far as jobs are concerned, scholars have to fend for themselves and most of the times they end up taking a lectureship in a local college.

3. The B.Tech crowd is the pampered lot. The placement services which are so extensively organised for B.Tech students, are virtually non-existent for research scholars. Ph.D. holders find it very difficult to find a job in India as they are considered overqualified by industry.

4. In response to how up-to-date the supervisors are, the group asserted that the instruments and the methodologies which are being followed are already 10-12 years old. The supervisors are quite “up-to-date” in these old methods!

5. IITs are meant for advanced learning and top priority should be given to research. But in actual practice, the priority has come to rest on B.Tech teaching. Teachers get sufficient mental satisfaction by working with this group and barely have time or energy left for research.



6. At times equipment is bought because the grant is available, irrespective of its immediate utility to the scholars. These, with the passage of time, become out of order due to lack of proper maintenance and getting anything repaired is more difficult than getting something new. Also, they become obsolete by the time a scholar needs them. Many a time, a whole line of research is initiated because a particular piece of equipment happens to be available at a particular lab. Research in their labs, said a few scholars, follows more a “logic of scientific opportunism than any logic of scientific discovery”.

7. Students said that there are times when they want to solve one problem in a particular way but the guides dissuade them from following these unpredictable, untried methods. The supervisors are solution oriented rather than problem oriented, and they take a solution they are familiar with, and try to apply it in a new domain. A few students find this very stifling and said that they came to IIT in the hope that they’ll get more freedom to work, but the environment here is not so conducive.

### **Talk with the Director**

**7.1.04** The Director, IIT spoke on historical lines about how science flourished during Jawahar Lal Nehru’s tenure, and later, how continuous deterioration set in because the planned economic investment in industry in the 1960’s required more money for their sustenance in 70’s. As a result education took a back seat. He threw light on a whole chain of events that followed World War II, and how Dhaka and Lahore universities, two important seats of learning were separated from India. Delhi being the capital is privileged in that it is the “melting pot” of people from all over the country and is probably the only “Indian city”. Other universities are “regional centres” where the scholars are all from local areas.

**7.1.05** Research as a career is definitely not an “economic proposition”. So even if a person is very bright in science, he goes in for medicine or engineering. The base of our education system is shaky. We can’t expect good quality research from these individuals with poor early training. Also this tendency of tolerating mediocrity manifests itself in the poor quality of our research.

### **One-to-One Talk**

**7.1.06** Variation in the replies of scholars to the same question was obvious, when asked individually in their laboratory or hostel and when together in a group. Following are the replies we got, when we talked to them on a one-to-one basis:

1. Were their anticipations, expectations and dreams with which they

entered IIT being fulfilled? To this the maximum response is negative. They agreed that infrastructural facilities are better but the environment is not really conducive for research.

2. The scholars were divided in their opinion about the competence of their supervisors. Majority in Physics had positive views while those in Chemistry were not very pleased with their guides' capabilities.

3. Individually, each scholar said that he is well protected from the kinds of harrassment that exist in other institutions.....

Despite good financial situation, research is not flourishing. Drastic change is needed in the research climate. A healthy atmosphere where free and frank dialogue takes place between the researchers and the guides is needed. Inspite of the physical proximity of the departments, no communication takes place. Even within the departments, faculty members who by their individual efforts procure some facility or equipment form an isolated group of their own. This kind of groupism is a definite hindrance to research.

NUPUR AWASTHI  
SHREYOSI KANTA

## **2. INSTITUTION "B", ANOTHER IIT**

**7.2.01** Another prestigious institution of India and our expectations sored, may be this is better than the other IITs. The campus is quite pleasant with deers roaming around freely and lots of greenery flourshing.

### **Views of Professors**

**7.2.02** Our first contact happened to be a Professor in Chemistry department. He talked at length about his project, methodology of work and the quality of research scholars working under him. He agreed that most of the scholars doing Ph.D. in IIT are from outside the Institute. 80% to 90% of the students in the PG class preferred to go abroad after their research work. They would sit for the GRE, GMAT exams and go out of the country. He said that IITs are heavily contributing to the brain-drain. His methodology of work is quite peculiar – he feels that one has to be autocratic to be productive. His scholars know that they are going to be grilled all along. He preferred his scholars to go through one or two failures before guiding them in the right direction. He said that this provoked his scholars to think and reflect on his idea. Talking about the theses being produced in our country, he quite bluntly said that they were mostly below standard. Even in the IITs, he said that, 15 out of 25 theses were either average or below average. He did not blame the students for this, but felt that it is the supervisors who do not have ideas and are unable to guide their scholars in the forefronts of scientific research. He said that out of about 400 odd



supervisors in all the IITs, only 50 were aware of the needs of the society and the relevant fields of research in our country. In his view all the Ph.D. students should be asked to sign a declaration that they will work in the country for at least 3 years after their Ph.D. and for this purpose, the government should create temporary Post-doctoral Fellowships in all the national laboratories, where these scholars can be absorbed and given the opportunity to serve their country as best as they can.

**7.2.03** Some of the other professors in Chemistry and Physics departments also had the same suggestions to avoid brain-drain. Most of them felt that it would be unfair to blame the scholars for going and settling abroad. Another interesting data which came out of these conversations was that about 95% of the brain-drain was at the undergraduate and postgraduate level. Though the research scholars also go abroad, but that is for only two years' Post-doctoral work. About 98% of them come back after their higher studies. The scholars also seconded this view.

**7.2.04** Another disturbing point which came to light was about research guidance. One faculty member was quite frank and stated bluntly that the quality of supervisors is very poor in their institutions, hence the scholars have also become mediocre. Even if a scholar happens to be a brilliant and dedicated student, he or she would get frustrated due to the supervisor's inability to guide his scholars. The scholars in the Physics and Mathematics department were a bit apprehensive talking about their supervisors, but when prodded a little, they said the same thing, i.e. guidance is not satisfactory. Many of them further said, that they felt that their guides either had very inadequate knowledge in the subject or they were unable to express themselves clearly.

### **Scholars' Views**

**7.2.05** Some of the other points which the research scholars brought out were:

- (1) They have no interaction with the other IITs at the research level.
- (2) There is negligible interaction amongst the various departments – if there is any, then it is on personal basis.
- (3) They have lots of problems with the non-academic staff, i.e. the laboratory assistants, workshop assistants, mechanics, etc. who have to be persuaded and begged to do the work.
- (4) Though the library facilities are good, but the management is very disorganised. A student is allowed to keep a book for 2-3 months. Now, if there are only a few copies of a book, and the students do not return them for long periods, the other students suffer.



- (5) Those who are CSIR-UGC fellows do not get their fellowships in time. Sometimes the delay stretches to 6-8 months, and in the mean-time, the scholar is left to fend for himself.

### **Lack of Direction and Planning**

**7.2.06** This is one institution where faculty members as well as scholars felt that science is a part of society and a scientist's main objective should be to identify the needs of the society before going in for research. Many of them pointed out that scientific research in India has no direction and lacked proper planning. The research workers were aimlessly swimming in the backwaters. As a result, the work ethos and the motivation to do some original research is also missing. Why should a good brain stagnate here if there is better opportunity elsewhere? This is a question posed by many of them.

### **Problems with Co-supervisors**

**7.2.07** Several scholars of the Chemistry department have more than one supervisor for their guidance. The students working under co-supervisors vehemently opposed this torture as considerable time and effort goes in keeping all the supervisors informed of their research activities. The guides are not in unison most of the time, and the scholar has to work twice as hard to try out the impositions of all and keep them satisfied. These students, however have slight advantage in that when their work is published they get first authorship as the supervisors generally don't compete among themselves.

### **Passive Supervisors get Credit as Authors**

**7.2.08** 65% teachers depend on their students for library work. Students lamented that their level of comprehension is lower than that of their guides who by virtue of their experience can derive more ideas from the same papers. The guides are more knowledgeable than their university counterparts because of their frequent visits abroad, and they also get exposure to the latest developments in their fields through the foreign guest lectures at IIT. "Honorary authorship", i.e. claiming of scientific credit where virtually no scientific contribution has been made is common in Chemistry department at this IIT. Often this happens when a senior scientist, who controls the funds for a research group that he directs, obtains credit as an author for scientific contribution that is, in fact, minimal.

### **"Scientist Bureaucrats": Younger Faculty**

**7.2.09** There exists a wide ranging disparity of thought as expressed by the

senior and not so senior faculty members. The younger generation of teachers stated that the department is ruled by a powerful class of scientist bureaucrats, the research czars, who are prominent and influential (often feared) members of the scientific community. Hierarchical suppression of the junior teachers makes them work under pressure which in turn affects their relationship with the students. This group of faculty members further added that only 10 to 15% of the scholars are bright and innovative, but in the present time-bound research system, one can't provide them with enough freedom to carry out their ideas. Most teachers rated only 15-30% of their colleagues to be up-to-date in knowledge.

**7.2.10** In short, the older men who hold the reins of the department have delegated responsibility but without authority. The delegation of responsibility is necessary to develop the abilities of a person but without authority it creates frustration and destroys initiative. This is what is happening presently in the department. Prof. Z's case can be taken as representative of the older generation of supervisors. Following is the gist of my conversation with him. He described himself as a "ruthless tyrant" and "through and through autocrat." The Ph.D. work of his scholars finishes in one to three years and after that they all go abroad. On an average he produces one Ph.D. per year and one paper per month. He gets his funding from various sources – Defence and ISRO sponsored work is to a large extent classified and for fulfilment of academic interest and paper publication he depends on CSIR and UGC funded projects. The paradoxical thing about this gentleman and several others of his kind is that while all of them advocated freedom and liberty for the young, they were at the same time proud of their being very strong and commanding.

### **Malpractices Cited**

**7.2.11** Most of the students in Department are first generation learners. Departmental seminars are held every week but these are poorly attended by both the teachers and the students. Library does not cater to the needs of the researchers who visit other libraries of the city for reference work. Students are very regular in attendance and can be seen working on a 9 to 5 basis everyday in their rooms. The sex ratio is 33% women to 67% men. Recently a girl scholar harassed by her guide got her registration cancelled and is now working under a guide from the Aerospace Engineering department as no person from her own department is willing to take her at the expense of their relationship with her previous guide. Another girl worked under a guide for one year after which he went abroad leaving her in lurch. She has now sought fresh registration and is working on a new problem with



a different guide. All the data collected during the first year has gone waste. In short nothing great about this Department.

SHREYOSI KANTA  
NUPUR AWASTHI

### **3. INSTITUTION “C”, A CENTRAL UNIVERSITY**

#### **Diligent Scholars, Poor Maintenance**

**7.3.01** University campus is neat and tidy and the maintenance of departments is good. There is an Enquiry Office in each department, which is very functional, unlike most other places and the receptionists cheerfully perform their duty of giving the desired information and guiding the visitors. Library and USIC are situated near the departments. There are several food joints in the campus which remain open till late in the evenings. The research scholars seemed diligent and sincere. Most of them are in their laboratories by 9.30 a.m. and almost all scholars we met were working in their labs. and not squandering away time in futile gossip.

**7.3.02** The main cause of discontent of researchers is the constant breakdown of equipment and lack of repairing facility. Also materials and chemicals which are needed daily are in short supply. This is a genuine problem encountered by all scholars and is especially frustrating for those who are at the terminal stages of their Ph.D. work. The researchers working under the Head of the department and other influential supervisors can still somehow manage the equipment and other research material but they suffer on the guidance front as their guides are busy with numerous other engagements.

#### **Too Many Scholars under One Supervisor**

**7.3.03** Since in recent years guiding a number of Ph.D. students is considered to be an index of academic and research performance and is an important consideration in matters pertaining to the career advancement of the faculty members, almost all supervisors take many student under their wing. They are, however, not able to divide their time and energy judiciously and provide adequate guidance, help and encouragement to all.

**7.3.04** The supervisors don't keep themselves abreast of the latest developments in their fields and all the new suggestions, methodologies, etc. put forth by the scholars are met with resentment. This was another problem faced by the scholars. The supervisors verbally berate their students for their



poor performance. They call for risk taking but punish even tiny failures. They want innovation but kill the spirit of adventure.

**7.3.05** There is little job opportunity after doing Ph.D. Hence majority of the bright students who are able to get through in competitive exams, leave research and join civil services.

**7.3.06** Supervisors were optimistic about the future of science in India. Most of them echoed the same view that the number of researchers should be reduced, the scholarship amount increased and job security provided to all those who are once taken in for research. They were of the opinion that the present day generation of research workers are more sincere, hard-working and willing to work, what is lacking is a truly conducive atmosphere for scientific work. They, however, didn't offer any solutions as to how an improvement can be brought about. One bright aspect here is that there seems no dearth of funds and no lack of good equipment.

NUPUR AWASTHI  
SHREYOSI KANTA

#### **4. INSTITUTION "D", A CENTRAL UNIVERSITY**

##### **Researchers' Association**

**7.4.01** At the outset we met the President of the Researchers' Association. He was appreciative of our research work and was highly critical of the teacher recruitment test. In his opinion this would further reduce the chance of Ph.D. scholars getting into teaching. A fresh M.Sc. student will stand a better chance as his/her general knowledge about the subject will be more, as opposed to a person engaged in Ph.D. whose thinking converges to his field of specialization. He offered to get the questionnaires filled, but needed about one month for it, so we decided to go on our own.

**7.4.02** In the Chemistry department, the labs. are widely scattered, untidy and have a very dismal look about them. The department is distributed in three buildings. The old block is in a dilapidated state and the rooms are dark and damp. The researchers come to the department at around 10.30 to 11.00 a.m. in several labs., the supervisors are the early comers. It is very difficult to trace the male scholars. Girls are the quieter of the lot and they didn't question us about any aspect of the questionnaire. The Secretary of the Researchers' Association who is a Ph.D. scholar of this department, assisted us on the second day in distributing and collecting the questionnaires. The scholars were more cooperative, but were apprehensive, to give their views in his presence. Most of them sealed their forms as a precautionary

measure so that he could not read them. This person got a lecturer's job in a college immediately after his M.Sc. and believes that Ph.D. is a mere formality in getting a job. It is the contacts one has, that matter. He does not face the difficulties encountered by his fellow researchers because even the supervisor thinks twice before dealing with him as he has the authority and backing of the Association. Scholars, in general, asked for the enhancement of Fellowship and increase in the number of hostel seats for researchers.

### **Supervisors' Views : Bureaucracy**

**7.4.03** The supervisors had received the questionnaires and were eager to express their views. Most of them said that the attempt was good but were not sure as to how truthful the respondents would be in filling the questionnaires. A professor asserted that the fault lies with the authorities – the administrators. Educational institutions are meant for the benefit of students, they are the cause of setting up of a university and for them the teachers are appointed. Administrators come last to see that the entire system runs smoothly. In India, the interests of scholars are always overlooked when research policies are framed. There are more than 400 researchers (including P.D.Fs and college teachers who have enrolled for Ph.D.) in the Chemistry department, but there is no common room where they can relax and have their lunch, etc.

**7.4.04** Another view expressed was that research in our country doesn't flourish because of oppressive bureaucratic practices of the people who are in power, and poor infrastructure. These problems can be overcome to a certain extent if researchers are dedicated. But in the long run talented and the dedicated workers too, tend to get disillusioned because of the depressing atmosphere that prevails around them.

### **Poor Interpersonal Relations**

**7.4.05** In the Zoology and Botany departments, the buildings are well maintained, neatly kept and systematically built, but the prevailing atmosphere in labs. is not exactly conducive to research as we gathered from a talk with the research students and guides. Personal interests, petty jealousies and tendency to keep one's work absolutely secret and guarded for the fear of ideas getting stolen, are some of the factors which prove a hindrance to healthy relationships that should exist amongst people working in the same field. The seminars where the scholars are supposed to present their work, are poorly attended and the main idea behind them, which is to enable a researcher to get suggestions from his colleagues for the



improvement of his work is never fulfilled, as the whole exercise is merely reduced to a leg-pulling affair, where supervisors in other laboratories sit and point out the loopholes and the weaknesses in a very unhealthy manner, said a number of scholars.

**7.4.06** Lack of encouragement from the guides who thwart the individual's initiative for the discovery of new knowledge and insist that scholars stick to the routine, was a complaint made by a few researchers. They say one thing in public, in publications, seminars, symposia, etc., but practise exactly the opposite in private. They speak of oppression of scholars, misuse of funds and things like that but don't think twice, in say, going abroad to attend a seminar and presenting a scholar's work as their own. According to them, most guides misappropriate the funds meant for scholars, in a way that suits them.

**7.4.07** Quintessence of our talks with researchers is that scholars of this university are more aware of the injustice done to them, of the malpractices prevailing in the system, and of their rights. Most of them were outspoken about this and said they all show their resentment one way or the other. Several suicides in recent years, dropping out of researchers after working for 3-4 years are some of the indicators of the dissatisfied state of the scholars. The number of researchers who are truly motivated and would pursue research as a career, given an opportunity is quite large. Scholars from other universities who have come here to do research, say infrastructure facilities here are definitely better, but as far as supervision is concerned, the guides are not better informed than the teachers at their respective universities.

NUPUR AWASTHI

## 5. INSTITUTION "E", A CENTRAL UNIVERSITY

### Campus Life

**7.5.01** The university is situated on the out-skirts of the city with an enormously big campus which is beautifully maintained. In an ideal condition, one should see students out in the open, jogging and exercising or else in the playground. But the place has a deserted look about it in the mornings and evenings. We attended a week long annual music festival and this too was poorly attended and organised. Each of the eleven science departments has its own workshop to fabricate, repair and alter equipment, but a special centre given to the University for the same purpose, called USIC, is some distance away and it remains idle or closed.



### **First Generation Learners**

**7.5.02** The University was to have students from all over the country but practically 95% are from one part of the State or are local people. It appeared that 50% of the research scholars were first generation learners, many were married off when they were minors. They come from very old fashioned and narrow minded background. Such scholars have a wife and a few kids to support, they are, therefore, in search of jobs urgently, and for many, undertaking of research is just taking up a job. A distinguishing feature of the students of this place is that they are very apprehensive about expressing their views. One reason is respect and reverence for their teachers, which prevents them from speaking out, and second is the language problem.

**7.5.03** Teachers have a very poor opinion of the scholars, and repeatedly said that students can't even write an application, if left to themselves. Interestingly, the scholars expressed similar views about teachers. Scholars without fellowship are well looked after, as they are provided financial support from the contingency grants of others, who have fellowships.

### **Good Laboratories, Inaccessible Supervisors**

**7.5.04** The Botany department is well maintained. Laboratories of Senior Professors are well equipped in contrast to the working place of junior staff. In Zoology, a few laboratories are doing good work. The infrastructure is as good as we have seen in any other leading university. In all other universities visited by us, the Zoology departments were female dominated, but here boys outnumber girl students. There is healthy interaction. Most of the researchers have attended seminars in other places, even outside India. A Reader in the Zoology Department reminisced about his student days and commented on student – guide relationship changing with time. In his time, the guide worked in the same laboratory as the scholar and one would have to just turn around to get guidance. But now the same guide has become a senior professor, sits in a separate room, and has become unapproachable.

**7.5.05** A bright young lecturer who has returned after 5 years of Post-doctoral study abroad, was full of criticism for the “out-of-pity” attitude of the departmental authorities in most matters, be it taking in of undeserving candidates for appointments or allowing substandard theses for submission and award of degree. An English research student, who is on a six months' visit to the Botany Department, found the atmosphere here more open, as opposed to the regimental working in England. Secondly, he finds the guide-student relationship much less formal here.

## **Vice-Chancellor's View**

**7.5.06** The Vice-Chancellor opined that students are not motivated because their future prospects are not taken into consideration while assigning them research problems by the guides. He blamed the teachers for the prevalence of plagiarism which according to him is difficult to trace because teachers are not up-to-date in knowledge; and are not reading their literature widely enough.

## **Ph.D. viva and High Tea**

**7.5.07** We attended the Ph.D. viva of a scholar. This was highly disappointing and seemed more of a ceremony rather than serious academic work. The emphasis was on high tea and not on evaluating the scholar. The Chemistry department is highly disorganized and the scholars, when asked to fill the questionnaire, were more interested in knowing how honestly we had been collecting data, or whether we spent all our time sight seeing. In Geology, we were told, scholars awarded the UGC/CSIR Fellowships, utilise the time to prepare for Administrative Service Examinations. If they don't succeed, they try public sector industry or Central or State Water Boards. If they fail to get anything else, they continue with research. Teachers often said, if the country cannot provide jobs even after Ph.D., why should they stop the scholars from continuing to try for all possible jobs.

MADHULIKA RAKESH  
NUPUR AWASTHI

## **6. INSTITUTION "F", A STATE UNIVERSITY**

### **Unique Leadership**

**7.6.01** The place has pristine calm and beauty about it with a titanic mountain stretching along the entire length of the university campus. Situated far from the madding crowd of the city, this seat of learning offers science study in four disciplines – Chemistry, Physics, Maths and Biological Sciences. The School of Biological Sciences far outweighs the rest of the three departments put together in the total strength of faculty members, number of students, subjects offered and the number of projects being pursued. From every faculty member we came across, we asked "What factors do you think have contributed the most towards the remarkably fast growth of your School?" And in every lab., we received the answers reproduced below and what intrigued us is that most of the teachers used exactly the same vocabulary, the same phrases and terms to express their views.



**7.6.02** Excellent leadership right from the inception of the school. Prof. X and his colleagues who laid the foundation of the department 15 years back, were highly motivated people with a catholic vision. They inducted the best brains irrespective of the constraints of region or religion. Despite a lot of opposition from the administration, the school appointed teachers from varied streams like Chemistry and Physics. In most other universities, Zoology department has pure conventional Zoology staff, and Botany Department has all faculty trained in Botany. This School because of the boldness, shown at the early stages, is now a good breeding ground for interdisciplinary studies and is well equipped to carry out the modern Biotechnology research.

**7.6.03** The Faculty consisting of 32 members is more or less of the same academic calibre. All the members have equal opportunity to work, irrespective of the seniority level. They collaborate in teaching, but as far as research is concerned, they have separate units spread out in as many as 7 buildings. These people have common lunch sessions everyday, where all their differences of opinion are sorted out, clarification of doubts is made and one can seek other's expertise and advice.

**7.6.04** As opposed to "stuffed shirt" formality prevalent in most other institutions, this School has an atmosphere of informality with a sense of responsibility shared, and the door open to all, especially to the younger lot. Except for the clerical staff, the rest of the department members, the teaching faculty, Ph.D. scholars and M.Sc. students don't have to sign an attendance register! Students work for extended periods even on second Saturdays and Sundays and one can find them working round the clock if the work demands so. Same is true for the guides.

### **Only to Join Foreign Research Agencies**

**7.6.05** Once they enter the School, the students learn very fast that they will end up joining some foreign research agencies because placements for their kind of work are non-existent in India. Unlike in the West, where industry and university research go hand in hand, and the researchers are absorbed by industry, here we don't have that sort of culture. Because of the taxation policies of our government, it is easier to get scientific equipment and chemicals from abroad and at cheaper rates, thus inhibiting the growth of local industries.

### **Bewildering Variety of Rules and Regulations**

**7.6.06** Faculty members and the students were unanimous in their criticism

of the working of Central Office. The teachers by their efforts get projects but have to face bewildering variety of rules and regulations regarding the use of money. A teacher cited a fresh incident in which he was getting a few chemicals from BARC, and when he sought the permission from the central authorities, they asked him for comparative quotation! Even for very minor expenditure, the office people make the process so long, conducting million inane enquires. The whole faculty expressed their resentment against this management philosophy based on distrust.

NUPUR AWASTHI

## **7. INSTITUTION "G", A STATE UNIVERSITY**

### **Inefficiency Greets You**

**7.7.01** Inefficiency greeted us as soon as we reached this university. There was no booking for us in the guest house, which, we came to know later, had been done by the Vice-Chancellor's office, but had not been communicated to the guest house caretaker. The guest house is newly constructed and looks quite nice from outside, but a visitor can easily see the defects and cracks in the walls as he enters his room. Despite all this, we had no problems because the people are very helpful.

### **Short Working Hours and Much Else**

**7.7.02** We started with the Botany department. Strange as it may seem, but we found a majority, about 90%, of the labs locked at 10.30 a.m. After hunting around for a clerk and making enquiries from him, we learnt that the scholars were present in the department only from 11.00 a.m. to 4.00 p.m. The only lab. open was that of Paleobotany. The scholars were very volatile about the condition of labs and rules and regulations of the administration. Very few of the research scholars spoke against their guides, but those who were bold enough to do so, gave us a clear-cut picture of the malpractices and harassment. One research scholar's topic was entirely changed after she had put in about two years work. We learnt that the supervisors do not contact their scholars for months together. Usually the scholars turn to the research associates in their lab for help. The equipments are quite out-dated and there are no funds to replace them.

**7.7.03** The Chemistry department had a very different atmosphere. The scholars did not seem to be very enthusiastic about filling our questionnaires. None of them criticised their supervisors. Very few research scholars attended their labs as most of them are preparing for the civil services exams. Even



the supervisors are not bothered (or may be they are helpless) about the low attendance of scholars. They say that the lack of job security after Ph.D. detracts the scholars from taking research seriously. They qualify the UGC and CSIR exams, and then utilise the fellowship money and the right to retain hostel facilities for preparation for the competitive exams. It is only after they cross the age limit for the competitive exams that they settle down for serious research work. This way most of them waste around 2-3 years. There are some supervisors who say that they try to discourage their scholars from following this practice, but most of them are unable to do anything about it. We had the opportunity to talk to the Head of the Chemistry department. He is the most unlikely person to be the Head. He did not seem to be interested in the future of science and research in his department. He said that lecturers and professors are paid to teach science and not to do research in labs, so why should they take up such "headache". On the other hand, another Professor discussed the subject very openly and enthusiastically with us. We came to learn from him that he and a few colleagues (from other departments as well) have set up a "Science Forum" in the University, whose main aim is to popularise science education and bring about a research culture amongst the students.

**7.7.04** The Mathematics department, which has COSIST level support from the UGC had a deserted look about it even at 12 O'clock in the morning. Few scholars, about 6 of them, were nowhere to be found. Some one from the lower staff of the department informed us that the scholars and supervisors usually operated from their homes and rarely came to the department. The library was also deserted and looked as if it was never used. Till the end, we could not contact any scholar or supervisor in that department. The Physics and Applied Physics departments had almost the same story to tell, except that we managed to catch hold of a few scholars.

**7.7.05** The Zoology and the Biochemistry departments seemed to be buzzing with activity. Though, the supervisors (except a few) were difficult to be found even here, at least the scholars were there. Dr.(Miss) X had quite a lot to say about the way money was being doled out by the sponsoring agencies. She said that people who had contacts with the high-ups usually found it very easy to get their bills passed. Even the projects were sanctioned to them without any questions being asked, whereas others had to run from pillar to post to get projects approved. She being a member of the selection committee also, gave us very good insight into the way a candidate is selected for lecturership. She said that most of the time they preferred their own candidates. The psychology behind this being that if they did not give opportunity to their own scholars, then who would do so. Moreover, the scholars of that university are more attuned to the atmosphere and

environment of the system and it is easier for them to settle down there. Despite all these factors, she said that she tries to select good candidates but most of the time she has to compromise.

**7.7.06** Writing about the types of scholars on the campus, only two categories were observed: (1) busy appearing at various competitive examinations; (2) busy in building their own leadership in various ways. No other category exists here. Perhaps they find being influential is more beneficial than being equipped with knowledge.

### **Poor Resources, Poorer Management**

**7.7.07** Finances and their management are also seemingly in a bad condition. All sections of the University seemed to be suffering from shortage and delay in availability of funds. Theses submitted 6 months back were not even despatched to the concerned examiners as the clerks, we were told, were not given money to buy cloth etc. for packing of these theses. Everyone knew about a UGC funded seminar in the University for which research fellows and associates were also made to subscribe heavily; lunches and dinners were provided by some firms, but everything was billed to the UGC. It was being mentioned that profits were distributed to many levels of functionaries.

### **Difficult for Girls to Work**

**7.7.08** Most of the departments function without any interaction. Inter-departmental cooperation is completely missing, interaction and cooperation between girls and boys was totally absent from the Campus. A unique pattern of sex bias was displayed creating an atmosphere in which, the female scholars can hardly work. The girls, as they told us, could not even think of working during evenings, after 4.30 p.m. The situation here seemed to be very different from that existing at IIT Kanpur, where girls moved around freely and went to their laboratories and Central Library to work even at very late hours.

MADHULIKA RAKESH  
SHREYOSI KANTA

## **8. INSTITUTION "H", A STATE UNIVERSITY**

### **Fight for the Top Place**

**7.8.01** The university is situated in the heart of the city, near the main market, hence it is easily approachable. A river flows right beside it and gives it a calm atmosphere.



**7.8.02** The university administration seems to be in shambles. The Private Secretary to the Vice-Chancellor informed us that the Pro-Vice-Chancellor of the university, who was acting as Vice-Chancellor in the absence of a Vice-Chancellor, had proclaimed himself to be the Vice-Chancellor of the university. Now that a new Vice-Chancellor has been appointed, he refuses to relinquish his duties and tries his level best to curtail information and letters from reaching the Vice-Chancellor who is, unfortunately, a very old and sickly person.

### **No Career Perspective in Research**

**7.8.03** The few scholars who are here, seemed to be disinterested in their work. There is absolutely no job security in the region. The Head of the Physics department told us that for the past 10 years, the vacancies in the department are not being advertised for political reasons. We met a scholar, who had succeeded in the Fellowship Test but who was very much frustrated and in utter confusion as to whether to join research or take up even a petty job. She said, if she took up research, then she had no future after Ph.D., and if she takes up teaching, then she will end up as a frustrated school teacher. Hence more and more scholars are availing the scholarships to prepare for the civil services examinations. Furthermore, for the last two years, students of this university have bagged top positions in the IAS, hence the motivation to prepare for this is increasing.

### **Poor Administration and Strikes**

**7.8.04** The administration is ridden with malpractices. The staff, i.e. the clerks do not pass the bills for scholarship, contingency grants, etc. The equipment and instruments are outdated, and there is no maintenance service in the university.

**7.8.05** Inter-laboratory and inter-departmental sharing of instruments is negligible. For example, the Botany department is divided in two blocks – the new building and the old building. Though the two buildings are side by side, yet the scholars from the old block cannot use the few good instruments installed in the new block. Research in Geology, Statistics, Mathematics and Physics is almost non-existent. Moreover, half the time, there is strike in the university – either by staff or by other employees, hence the university is closed and all activities including research come to a stand still.

## 9. INSTITUTION ‘I’, A STATE UNIVERSITY

### Research in Colleges in a Big City

**7.9.01** The new campus is not very well kept and everything seems disorganised, though many of the buildings have been recently built. The Life-sciences building is about a year old and lacks equipment, facilities, etc.

**7.9.02** The research in science is not only confined to the University departments, but is carried out in many of the affiliated colleges. There are about 70 affiliated colleges and research scholars can be found working in about 25 of them. We tried to cover as many colleges as possible. Being a big city, it becomes extremely difficult for the scholars of the different colleges and university departments to interact with each other. Similar difficulty is faced by the scholars, when they have to interact with scientists in industries and research institutes. One of the supervisors, we met, pointed out that the scholars have to travel at least 2-3 hours to reach their destination and they waste the same amount of time going back. The hostel facilities are not at all adequate. One of the colleges has closed down its hostel and has asked the scholars to find their own accommodation, which is again a problem in such a city.

**7.9.03** Most of the colleges, being dependent on the University and the State Government, lack in funds. They do not have adequate infrastructure for research. Most of the scholars are full time lecturers in the undergraduate or junior colleges. Their main aim is to get a Ph.D. degree some how or the other, which is required for further promotions. Thus, we found very few research scholars in the colleges, who are really interested in original research. A lot of these lecturers take students for private coaching, this is very tempting for them as it is difficult to make ends meet in a big city on their pay only. Therefore, they have very little time to devote to research.

### Procedural Delays

**7.9.04** In the University, there is a great deal of ‘red tape’ in ordering any equipment. The application has to pass through various channels like the departmental office, Head of department, Finance-Office, Registrar, Vice-Chancellor and then back through the same route to the department. This takes a long time and questions are asked at various stages. The rules and regulations are also very ambiguous and bureaucracy reigns supreme. Due to these tedious and time consuming rules regarding finance, the scholars get discouraged.



## **Readymade Theses**

**7.9.05** I can't help but mention a gentleman who is a senior professor in Botany department of one of the Institutes of the University. He is triple Ph.D. (from two Indian universities and one abroad) and D.Sc., works from 5.00 a.m. to 12 p.m. and is the typical-I-know-all and all-know-me kind of personality who loves speaking about himself and his contacts, and how popular he is with the rest of the world. He specialises in plant physiology, ecology, pollution, to name a few. He has got a very sympathetic attitude towards his scholars and said with obvious pride that he is famous for producing scholars in the shortest time period. He helps the students to finish their work in record time by masterminding the entire plan for the Ph.D. project of the scholar before hand; doing all the library and reference work, specially for the poor girl students, who in addition to their research also have a family to look after; preparing posters, papers, reports for seminars, conferences symposia, etc. and finally writing the entire thesis single handedly!

## **Bright Example of a College**

**7.9.06** We make a special mention of microbiology research at one of the major colleges because the guides as well as the scholars are satisfied and the environment is very encouraging, bubbling with activity and good will. The creativity of the scholars and the guide is well exhibited in the upkeep and designing of their research set-up. The guide, rightfully proud, took us around the entire place, every inch of which is judiciously utilised. Hostel facilities are excellent, unlike in other colleges, and so researchers can spend as many hours as they please on research. The scholars, who have moved out of this research unit and are now working abroad, still keep in touch with their old labs. They bring chemicals and other small portable instruments whenever they come to India. As a result, there is never a dearth of proper materials for research. The guide laments the fact that best of his scholars have to go out of the country, as we in India can't provide them the place to bloom. He cited several examples of this kind from amongst his students. A particular very bright scholar, after having finished his Ph.D., joined Bhabha Atomic Research Centre, but "could not survive in the hierarchical, bureaucratic set-up where he found himself at the bottom of the ladder". He is presently heading a very prestigious research unit in the United States.

## **Mobility of Project Leaders Leaves Scholars in the Lurch**

**7.9.07** The problem which we are going to mention now has hit at least 3 researchers. A supervisor took up a project with DST and decided to leave it in the middle as he got better placement elsewhere. The scholars who were

working under him had to discontinue this work and the Head of the department transferred them to a new research guide who was not at home with the subject and so gave them a new topic to work on. All the previous work got wasted. It is a rule of the DST that when the principal investigator decides to quit in between, they terminate the project and take back the instruments bought with the project money, ignoring the effort that was put in procuring them and the fact that scholars might be using these pieces of equipment and their experiments may also be half-way through.

SHREYOSI KANTA  
NUPUR AWASTHI

## **10. INSTITUTION “J”, A STATE UNIVERSITY**

### **Earn and Learn Programme**

**7.10.01** This university is situated in this historical and picturesque city. The campus itself is a beautiful place and well-maintained. As we learnt later, most of the colleges and universities in this State have a programme called “Earn and Learn”. Under this programme the students from low income group are encouraged to do some work like gardening, cleaning, etc. for which they are paid by the University. In this way, they are able to support themselves and pay for their education. Usually this programme is implemented in the early morning hours, so that the students do not miss classes.

### **Local Politics and Research**

**7.10.02** The atmosphere in some of the departments was oppressive with politics and bickerings amongst teachers. As usual the Mathematics and the Statistics departments wore a deserted look with neither any supervisors nor scholars. We met the Head of the Mathematics department. He said that Mathematics being a theoretical subject attracted very few scholars. Moreover, the new rule regarding the in-take of scholars through NET exam has also reduced their number. This being a weak university, cannot boast of good results in the NET exams. About 5 or 6 years ago, two students from the Zoology department had qualified the CSIR exams. – the result has been nil thereafter!

**7.10.03** Strangely enough, there was only one research scholar in the Chemistry department, though the Biochemistry unit had five. Prof. A of Biochemistry unit informed us that Prof. X, Head of the Chemistry department, was responsible for the closure of research labs. Prof. X is a product of this university and, is said to have managed to reach this position



quite early in his age, while he does not care for research. Prof. A has been trying his level best to get the Biochemistry unit separated from the Chemistry department, but in vain. He said that he has to face a lot of hurdles, especially in research, due to the non-co-operative attitude of Prof. X. For example, the scholars were not allowed to feed and take care of the animals in the animal house in Prof. A's absence. As a result, all the animals died and now they don't have any animal to carry out their experimental work. There were many such complaints and other irregularities in the department which were pointed out to us.

**7.10.04** The same story was repeated in the Zoology department. Apparently, the position of the Head is permanent, and Prof. B has been holding it for the past 15 years. He and his wife, who is a Reader in the same department, are at the helm of affairs. The other Readers complained that whenever the post of Professor is advertised, there is a biased selection. There is alleged bungling of funds from the project money. Usually the important and well-funded projects are sanctioned to the Head or his wife. It was said that Prof. B is absent from the department for 15-20 days in a month (as shown in the attendance register of the department) and yet he is churning out lots of Ph.D. theses every year! We went around the department and found very few scholars working in their labs. The DST lab. for research in endocrinology wore a deserted look everyday. Though the lab. was open, but it seemed that nobody ever worked in that lab. and it was never cleaned. There was dust everywhere, including on the few instruments lying there.

### **Good Examples among Bad**

**7.10.05** After being disappointed in the above departments, we were a bit apprehensive of going into Botany and Physics departments. Thankfully, the Head of the Physics department is a level-headed person and he talked to us very amiably about the problems faced by his department in research. He said that there was a dearth of scholars in his department due to the lack of motivation for research amongst the post-graduate students. Most of the colleges affiliated to this university are in the interior areas, where the lecturers themselves are unaware of the latest developments in Physics. Hence, they impart outdated knowledge to the undergraduate students, who in turn are unable to decide their field of specialisation in the post-graduate course.

**7.10.06** There was a lot of research activity in the Botany department. Through the mist of politics, we felt that there were a few people who were dedicated to teaching and research. Dr. F along with Dr. G has developed a beautiful botanical garden in the university. Dr. F's experiments on leaf protein were also carried out in this garden. He seemed a bit frustrated

regarding his promotion. Also, he was denied a scholar of his choice for a long time, but now a student from Europe is coming to join research under him. Most of the research work being done in this department is agro-based. Dr. H is engaged in a project on pesticides. His group of research workers are also working on the harmful effects of pesticides. He informed us that he has organised many awareness programmes for the farmers of that region. These farmers also come to him for advice on the use and dosage of various pesticides. He is planning to translate his books on pesticides in the local language, so that the farmers can consult and study them. His main problem is getting funds for this kind of work.

**7.10.07** Moving through the thick of the campus, talking to supervisors and research workers, visiting labs and gathering some vital information from the administrative staff, we came to the conclusion that if politics and bickerings amongst the research guides and Heads of departments are removed, then the university can flourish as the scholars are hard-working, intelligent and sincere. All the authorities as well as the teachers seem to be very worried for the safety and security of their positions. Instead of doing research in their subject matter, they are usually busy researching into the loopholes in the work of others, specially those who are senior to them. Big files and records are being maintained by them in this respect.

MADHULIKA RAKESH

SHREYOSI KANTA



## CHAPTER VIII

# Recommendations to Improve Scientific Research in the Universities and IITs

### The Need for Positive Action

**8.01** The data provided in the previous Chapters, and the discussion which has followed would make it clear that the great potential of scientific and technological research in the universities for advancing the frontiers of knowledge and for contributing towards a self-reliant development of the economy, is not being properly realised. Although university research is said to be cost effective, and since it banks on the ever refreshing creativity of the young, it is known to be most productive, yet it is a matter of great concern that this research suffers from a number of handicaps and self created difficulties which are perfectly removable. In spite of general awareness of the deficiencies positive decisions to improve the situation have not been taken. This may be because a lot of people feel helpless when they realise the widespread nature of these deficiencies in many institutions and even in society at large. For a lot of others, the attitudes of tolerance and charity displayed in connection with judgement of scientific merit, carry over to reconciliation with all manner of unhappy procedures and practices in research. There are also those who are themselves the makers of the various shortcomings in the organisation of scientific research who find it convenient to condemn these practices in words, but are not willing to work out a practical programme to eradicate the evils.

**8.02** Now that most of the shortcomings have been analysed and laid bare, it is imperative that steps be urgently taken to remove these shortcomings. The scientific community has to stop being complacent because it leads to lack of action. It has also to get over the tendency of neglecting university research and its numerous problems, with the consolation that even if conditions are difficult in the universities, research is flourishing in other institutions. This is perhaps an illusion which has to be guarded against, because the nation is one in temperament, and the style of work of our people is also similar in different kinds of institutions. It is quite possible that the

maladies afflicting the universities are also found in other institutions of scientific research. It would, therefore, be a significant step forward, in the interest of national development, if what is known to be wrong in the university system in an indepth study of the system is boldly and squarely tackled.

**8.03** In the succeeding paragraphs it is not intended to provide a comprehensive statement of policy towards improvement of university research. The more important aspects, which directly emerged from this study are the basis for making a set of recommendations. Acceptance and implementation of these recommendations would have a healthy effect on the entire system of scientific research.

### **Adequate Financial Support**

**8.04** The first point is about financial support to research in the universities. This has been stressed in many documents and from various fora. A view has been taken in this Study that proper financial support is necessary, but this alone cannot bring about a radical change. Nevertheless, financial resources have to be provided, because otherwise many non-financial inputs will also become infructuous in practice. There is tremendous material poverty among the institutions of higher education in respect of scientific research. Even the best institutions have reported the feelings of a large number of scholars and supervisors that their facilities in respect of equipment, library, documentation, computer facilities and infrastructure are "poor" or "very poor". But there are many other institutions carrying out scientific research where the situation is much worse, for example, in colleges where 15% of scientific research is being done. The condition of services of all kinds which are essential for any noticeable improvement in research, for example, maintenance of equipment, technical and administrative support, etc. has to be vastly upgraded with additional posts and infrastructure. The perception of thousands of scholars and supervisors is that these services are in a really shabby state.

**8.05** With inadequate or obsolete equipment which often goes out of order, with little technical support to design and fabricate experimental arrangements, with shortage of contingent money to buy essential consumables, with inadequate library support and lack of money for travel and personal contacts, one can well imagine what kind of research will be produced! Undoubtedly there are other factors which have to be taken care of, but, what is of prime importance has just got to be provided first. If we fail to provide this, in a sense we would be guilty of maintaining university research in an emaciated condition, and allowing it not to make a contribution in building up the strength of our nation.



## **Reform of Education Preparatory to Research**

**8.06** The Study has brought up very sharply that our post-graduate education does not, by and large, adequately prepare students for research. It has also been found that a large number of our better students are not attracted to research careers. This is a dual task, and we have to address ourselves to a radical improvement of the educational programme whose specific weaknesses have been identified. It has been shown that the scholars have great deficiency in language and communication skills. If a substantial proportion of them are unable to comprehend scientific literature, books and journals are hardly of any use to help them. They, thus, are deprived of the world of knowledge that has already been created and are bound to fumble in pursuing any problem that they are investigating. Here, there is no question of any narrow nationalism about language; if English is the language in which most of the scientific literature reaches us, then our scholars should better be competent in the use of this language for comprehension of literature and effective expression of their thoughts.

**8.07** It has been found that in the vast majority of cases, the knowledge of the scholars is not only shallow but it is confined to their subjects. It is accepted as a fact of life that research flourishes on original ideas which come from a variety of sources, and first of all from subject areas which have a common border with the special field in which research is undertaken. Inter-disciplinarity, and a broader base of scientific knowledge are an essential ingredient of preparation for research.

**8.08** A great deal of research is related, directly or indirectly, to environmental, social or economic development. Fortunately, our scholars and supervisors have come to believe that scientists must concern themselves with social and economic development. However, their knowledge of such development is practically nil and hence there is a natural tendency to be superficial or to sway with fashionable trends. Opportunities have to be provided at the Master's level or during Pre-Ph. D. training to cultivate serious interest in broader social-economic and technical problems which concern the future of our people. In the absence of any orientation towards the relationship between science and technology, on the one hand, and alternative pathways of development, on the other, a scientist would merely be a tool in the hands of those who run the social system. Strong scientific contribution to solve problems which would affect the welfare of the people, is only possible if scientists were exposed to serious discussions of numerous social, economic and political issues which the country faces.

**8.09** Experimental skills have been depreciated not only because of lack of

physical facilities but also because of the attitude of the teachers and supervisors to downgrade the importance of acquiring these skills, by giving nearly maximum marks to every kind of performance in the laboratory. It is all the more a pity because 50% of the time is usually given to laboratory work in the post-graduate classes.

**8.10** It is well known that creative abilities are developed by doing creative work. Therefore, small research projects have become an integral part of even undergraduate education in many countries. Our system is woefully inadequate in this respect since it largely relies on reproduction of memorised material in examinations. Analysis and synthesis are rarely required. This has to be changed in order to bring in many types of theoretical and experimental work requiring some original thinking, designing, planning and execution.

**8.11** The outlines of a new Master's level and pre-Ph.D. programme have emerged out of this Study's specific findings, this kind of educational change has also been often recommended and sometimes some institutions have even moved in this direction. But unfortunately, traditionalism and lethargy have often come in the way of sustaining such good initiatives. Out of its very character, the new approach requires collaboration of many Departments and Faculties and this is difficult to obtain in our conditions because each university has weak and strong departments, the weak outnumbering the strong. The weak Departments and the majority of their teachers prevail to maintain the old patterns of work. The affiliated colleges have also to be carried along with any innovative teaching programmes but they are usually in no position to implement such programmes. Hence there is a strong tendency to maintain status quo. Experience tells us that new kind of programmes, with corresponding evaluation system, are working without much of a hitch where they were introduced from the day of the founding of a new institution. The Indian Institutes of Technology and the Agricultural Universities are an example. When the faculty is recruited, it knows that teaching, examination and the structure of courses required for a degree will be in accordance with the given design. Hence in order to get results in the Indian situation, while the pressure for change in the desired direction should be maintained on all universities, and those that are willing to change should be supported with all resources that the UGC can command, it would be wise to take into account our past experience, and ensure that when new universities are set up, they should, from the very first day, follow a new pattern of education. In the past few decades, when it was decided to upgrade higher technical education, the Indian Institutes of Technology were set up. It is time that the country decides to set up, at least a few institutions along the above mentioned lines for undergraduate and post-graduate education



in the sciences, social science and the arts. Since new institutions of this type will be limited in number, it would be natural to have rigorous, merit-based, country-wide, selective admission to these institutions.

**8.12** It must be admitted that even such a rational and necessary change in the pattern of post-graduate education is not easy to bring about. Improving competence in English language can raise political and nationalistic sentiments. Broad basing of knowledge in the PG course would go against the established beliefs of the academics with regard to specialisation, and cramming in of as much information as possible. Bringing about an understanding of current socio-economic problems, particularly with reference to the potential contribution of science and technology, would be problematic because the faculty which prescribes the scope of courses is itself ill prepared in this area. Creativity is also a rather novel concept for most teachers and they are likely to be luke warm to new activities which this would involve. This entire reform is truly at the mercy of the faculty. If it is determined to bring about a change no one can stop it. If it takes a negative view, no meaningful reform can be brought about.

### **Provision of Clear Career Prospects**

**8.13** This Study in general, and the anecdotal reports from widely dispersed institutions in particular, have revealed attitudinal and motivational problems on the part of the scholars in respect of opting for research careers. The problem here is, first of all, to motivate the best students of the post-graduate classes to prefer research over other possibilities. This is not happening to the desired extent because people do not see career possibilities (of successively higher salary scales in course of time, with a measure of security, based on reasonable performance) in this field, as they see in administration and many other kinds of services in the country. Even though, on the basis of the National Examination, a Fellowship may be conferred on a scholar, the stipend lasts only for a few years and one has to look for other openings. A Ph.D. degree, obtained at around the age of 32 years, can still not ensure a job. In fact, at the moment there is evidence of rising unemployment among highly qualified scientists. This state of affairs is all the more a matter of concern in India because tuition fees are nominal and the entire expense of education and research is borne by the taxpayer, therefore, not employing the end product of this process, is great waste of national resources. It is also important to realise that utilisation of the results of research creates a motivation and even enthusiasm to pursue research. In our country both the motivation factors are non-existent.

**8.14** It is possible to imagine a few steps which can definitely improve the

situation. Firstly, a number of steps are being suggested in succeeding paragraphs to improve the quality of research, and to make its evaluation more rigorous. A student who gets a Ph.D. degree under such strict conditions should be entitled to a suitable job in the system. The research agencies, who are not presently employing an adequate number of Ph.D. level scientists, should revise the qualifications laid down for the first level of appointment in these agencies. The Master's level of qualification was adopted many decades ago when the output of Ph.Ds from the universities had not reached a proper size. Now that people with doctoral qualification are available, the agencies should revise qualifications so as to employ Ph.Ds in much larger numbers. A parallel system of posts with the designation "Research Scientist," which has already been created by the UGC in the university system precisely to promote research careers should be expanded so that substantial staff is provided to the universities for undertaking scientific research. This scheme of Research Scientists already provides for a five yearly evaluation of research work and a continuation or even a promotion to a higher rank on the basis of good performance. Thus a research career would be ensured for a person who continues to do good work. It has also been suggested in various seminars, and it is a very useful proposal, that everyone who obtains a Ph.D. degree should be registered at a Cell, specially created for this purpose, at the UGC, and the names of people so registered, should be circulated by the UGC to all relevant institutions and agencies for possible selection to regular posts.

### **Utilisation of Good Applicable Research**

**8.15** Utilisation of good and applicable research done in the universities, which according to this investigation may be represented by over 700 theses every year, would definitely be in the interest of national development, and it would be a great impetus to the research spirit in the universities. Unfortunately, there is no agency or system at present to keep track of or collate such research and provide a bridge to channelise it to user agencies. Besides this research, there are many cases of innovative equipment and materials which have been developed by scientists in our universities, which also do not reach possible users in other institutions. These have not been productionised and made available to the consumers, who, in many cases, may be the teaching or research institutions themselves. Of course, this need not be a one way process, the entire system of research would be benefitted if the user agencies and government departments (such as Agriculture, Industry, Communications, Transport etc.) could identify problems which the scientists in the universities could help to solve. This would be particularly true for problems which require some basic work for their solution. The new agency which needs to be set up may be called the "National Research



Council'' and it could facilitate the two-way give and take between university type of research institutions and the users of research. The name itself connotes other roles for the Council which will be outlined in a later paragraph (8.27).

### **Enforcement of Scientific Values**

**8.16** The Study undertaken here has indicated many shortcomings of the supervisors, which are of a crucial nature in determining the quality and value of research done in the universities. The evaluation of academic work whether at university examinations or at the level of the Ph.D. theses, can hardly be called fair, just or objective. This leads to indiscriminate award of marks, often to undeserving people, and of acceptance of theses which are of doubtful merit. Similarly favouritism or victimisation of people by not offering them recognition or jobs, due to a variety of irrelevant parameters, is something of which the votaries of pursuit of truth, in the form of scientific knowledge, should take immediate notice. Malpractices of various kinds have crept in and they have to be strongly checked, otherwise practically all research will loose credibility. These are matters in which the supervisors themselves have to do some introspection and adjust their values to the demands of their profession.

**8.17** In this connection, the UGC cannot escape responsibility because, according to our Constitution, the Commission is charged with the maintenance of standards in teaching as well as in research. In fact, in 1984, the Commission has taken a set of decisions to improve the standards of research in the universities, which were circulated to the universities but have, unfortunately, remained unimplemented. The Commission, for example, had asked the universities to have a summary of the theses prepared whenever theses are submitted, which may be circulated to other departments and institutions, and in this connection it further suggested that five copies of the summary reports be supplied to the UGC. A copy of each of the examiner's reports on the theses was also desired to be sent to the UGC, and in case of divergence of opinion and the appointment of other examiners, the reports and the names of the examiners were required to be sent to the Commission. The Commission intended setting up a suitable system to review the summaries and the examiners' reports, so as to prepare for its own information, a report on the quality of research being done in the universities. Any anomalies observed would be confidentially sent back to the concerned universities. It is high time that some such control should be exercised over the quality of research produced by the institutions, because in the unrestricted freedom enjoyed by them, standards seem to have gone down, and undesirable practices have crept in.

**8.18** Furthermore, in connection with either undue favouritism or victimisation, and other forms of malpractices the situation seems to be very disquieting. Miscarriage of academic justice and the resultant promotion of that which is known not to be the best are seen from the data to be more common than what may be inevitable. Since scholars are at the mercy of supervisors who can make or mar their careers, it is imperative that some manner of protection should be available to them. Perhaps the very existence of a mechanism to seriously examine cases of blatant prejudice or favour (or other unethical practices) will deter supervisors from giving play to their hidden sentiments. The mechanism cannot be confined to a single university in the Indian circumstance, and it can also not be entirely centralised because of large geographical spread and wide prevalence of these malpractices. Hence the UGC should take the initiative to set up a number of zonal committees, each covering several institutions, and having a few members of known integrity. Scientists from any institution could be selected for the membership of these committees, which may be called Committees for the Protection of Scientific Values. These Committees should be given the power to make suitable enquiries when a complaint with evidence is filed before them, and their findings should have a moral force so that proper remedial measures are taken.

**8.19** The question of malpractices related to manipulation of data, plagiarism and other kinds of fraud has also to be taken very seriously. The data as well as the anecdotal record indicate that there is a significant number of such cases plaguing our scientific research. The pity of it is that even when clear cases of professional misconduct of this nature are brought to light, many universities plead helplessness and strong Vice-Chancellors also report that the rules of service and conduct prevent punitive action from being taken. Surely the rules did not visualize the situation as it prevails, things being made worse due to natural difficulties with obsolete or broken down equipment, and the mad race to publish and produce Ph.Ds at any cost. The rules have to be changed to make professional immorality and misconduct, when it is established, as a serious offence giving rise to corresponding punishment. It is suggested that the Committees for the Protection of Scientific Values should be also entrusted with the work of enquiring into such cases and recommending punishment.

**8.20** For the health of scientific research and maintaining a high and dependable quality of output, these measures are necessary. Fortunately, realising the growing threat to scientific values, a national Society for Scientific Values has been set up in the country, which already has a large membership and which has built up credibility with the academics concerned.



The UGC can look for cooperation from members of the Society in setting up a mechanism which suits the university system.

### **Continued Learning and Self-Discipline for Supervisors**

**8.21** The supervisors have not only to improve their broad but also specific knowledge and continue learning by various facilities provided to them, because the scholars perceive deficiencies in this respect. Struggle to fight obsolescence is part of the game. They also have to take keen interest in the work of the scholars, in the sense that they should be closely associated with every facet of the research, so that they can give timely advice, and provide satisfaction to the scholars that they have actually participated in their research. It is necessary that supervisors enforce a discipline on themselves so that they meet the scholars with regularity, in accordance with a known time table as suggested by the UGC. Limiting the number of scholars under each supervisor is part of this very conscientiousness in pursuing research. When discipline is enforced on their own selves, supervisors will be in a much better moral position to demand an honest day's work, as well as work for a major part of the year from scholars. These are matters related to discipline and ethos of work and are not as difficult to implement as a proper sense of values and professional conduct. It is suggested that the record of a teacher in this respect should be available to any selection committee which wishes to evaluate his performance.

**8.22** Seminars for students to report their work, and seminars with outstanding experts to talk to the scholars on recent developments should be introduced in the form of departmental activity. Contacts through departmental and other seminars are essential for keeping abreast of growing knowledge, and in order to facilitate organisation of such seminars, or participation in others, it is suggested that the supervisors be provided resources for travel and communication by telephone, telex or fax. This will help to update the knowledge of the research community. There is world-wide experience that contacts of this kind contribute a great deal towards keeping people abreast of recent developments.

**8.23** Improving the processes of research is an urgent necessity because what prevails at present gives cause for great concern. The UGC, apart from specific measures recommended above should cause the issues to be widely discussed, perhaps, by circulating the findings of this Study so that better practices are established in the laboratories and departments of study: with appropriate processes of guidance and evaluation. With sincerity of purpose reflected in discipline of work, both the morale of the workers and quality of research will receive a fillip.

## Promote Linkages and Connectivity

**8.24** The Study has revealed a rather shocking isolation of the universities from other sectors of research and production activity. Each set of institutions and agencies seems to be working within its own confines. Only a few agencies such as the CSIR and the DST support research in the universities or benefit from any of their work. There are many agencies which do not figure at all in the large sample of departments which supplied information. The industries are particularly negligent of university research and their support, in any form, is of the order of just a few percent. Exchanges in the form of personnel from one set of institutions visiting another for substantial periods are also negligible.

**8.25** Linkages and connectivity have to be greatly strengthened because they imply better utilisation of human and material resources, cross fertilisation of ideas and, ultimately, better quality of research. In India, the linkages and the state of mutual cooperation and sharing are in a sorry state even within an institution and among its laboratories. The culture of exclusion, secrecy and individualism is strong, but it has to be changed in the interests of improving performance. Some of the suggestions which may be made in this connection are as follow:

(i) The universities should involve experts from research institutions and user agencies in curriculum making, in selecting problems for research, and as members on research committees. This will enrich research work and help to create a measure of confidence among the users of research regarding its quality. It will also facilitate placement of the researchers in suitable jobs. Each university should set up a Research Board, with the participation of experts mentioned above, to actively promote research in the institutions through interchanges, seminars, and cooperative use of facilities. The Research Boards should explore opportunities to obtain funds and expand the research activity. The present boards of advanced studies and research only carry out the basic functions of approving the names of research guides and topics of research, and thereafter appointing examiners and rather superficially looking at their reports to award degrees.

(ii) It may further be suggested that within a State or region, the universities and institutions of higher education should be brought to a common forum to coordinate ongoing and planned research in the context of the developmental requirements in the region. A possible framework of multidimensional linkages which represents this thinking is presented in Fig. 8.1. This is also in consonance with the recommendations contained in the Programme of Action approved by Parliament in 1986.



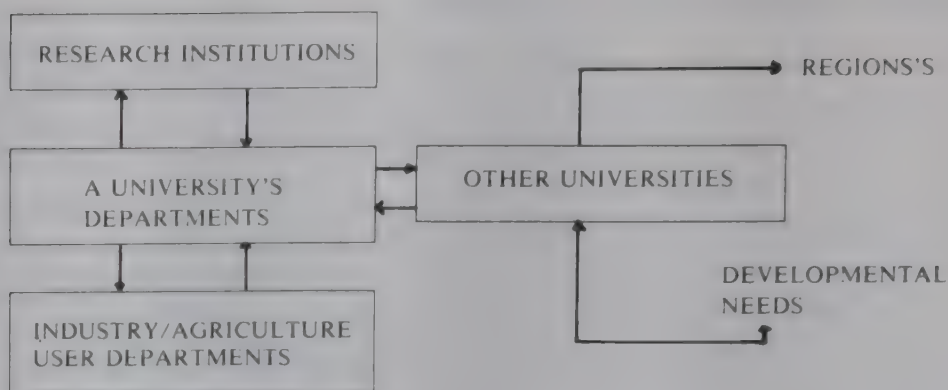


FIG. 8.1

**8.26** In view of the pivotal role which university research plays, or at least, could play, in national research, close association of the universities with frontline work taken up under the auspices of government departments or agencies has been advocated, and accepted in principle, for more than 20 years. However, whenever a special research laboratory is set up, it is invariably outside the university system. There are some encouraging signs of change of attitude, but as yet new activities in close cooperation with the universities have not crystallised. It is, therefore, important to reiterate at this point that whenever a research thrust is to be promoted by the setting up of new laboratories, thought must be given to do so in close association with the university system so that young scholars can be involved, and teaching in the universities also receives a fresh impetus. The management of such facilities should be established on some autonomous basis depending on each situation, because isolation from the universities is to be avoided, but getting too closely tied to the internal pressures in the university system could also be counter-productive.

### **National Council for Research in Institutions of Higher Education**

**8.27** It has been strongly recommended in the past and, in particular, a whole Chapter was devoted, in the Programme of Action approved by Parliament in 1986, to issues pertaining to the organisation of scientific research in the universities. Here, it was recommended that a National Council for Research in Institutions of Higher Education should be set up in order to consolidate and coordinate research in the universities and to plan the thrusts of future research, in keeping with the demands of national development. The Council would not only cause financial support to be given to the institutions, but would also conduct studies on the performance of the system, on international developments and on policies needed to keep abreast in various disciplines. Linkages between institutions in various systems

cannot be unilaterally or easily created as we have experienced in the past. Therefore, the Council could be an excellent instrumentality for creating national coordination in the utilisation of university research.

### **Special Support for Basic Research**

**8.28** A very important question on which light has been thrown in this Study is the proposition of “basic” and “applied research” in the universities. It must be a matter of great concern to scientists, that, in all probability “basic research” is being given a secondary or residual position in our universities. The fact is that today’s basic research is tomorrow’s applied research. In recent years, in most front line areas, basic research is being converted into a variety of applications soon after it is done. If we are to remain competent in the future, and if, even our applied research has to reach truly high standards, we must take positive steps to promote and expand basic research in the universities. Therefore, special funds, special positions, and special institutions and facilities, have to be created, by careful consideration in various disciplines of science, to undertake investigations of a fundamental kind.

**8.29** A specific point which has emerged is that university departments, as different from those in the IIT’s are not provided funds of their own for research. Therefore, unless projects are approved by the UGC, or any of the other agencies, the departments are obliged to spend any money required for research only out of their limited contingency grants, or grants meant for the teaching laboratories. This is a definite handicap and sometimes even preparatory work needed to formulate a project cannot be done. Hence it would facilitate and encourage research in the departments if they had a lump sum grant for any expenditure related to research. Too many questions need not be asked before releasing the small grant, because there can be great variety of needs. The amount could be of order of Rs. one lakh per department per year, the actual amount being fixed in relation to the size of the faculty and the fields of its interest.

**8.30** Management and discipline have been found to be the weak points in the organisation of the departments conducting scientific research. They are indeed a part of the general ethos prevailing in a university, or sometimes even in the State in which the university may be situated. But successful and expeditious performing of research is the result of harmonious interaction of a number of sections or services available to the department. Facilities with regard to documentation and the workshop, and of handling the consumable stores, or purchase of materials, etc. and many others, have to mesh into each other in order to produce results. Observance of hours of



work, conscientious discharge of duty, and team work are all necessary. The research workers too have to be self-reliant in a number of skills, but they should also possess the art of getting work done by others. The supervisors and the heads of department play the most important part in making this complex system work. It has been found in this Study, that the best administration is either "democratic" or "fair-minded." Thus, the task of the Head of the Department is extremely complex – he or she has to have intellectual qualities of leadership combined with the gift of making the research workers enthusiastic about whatever they are doing, and an ability to administer within a democratic framework. This kind of administration alone can take the most advantage out of the free and non-hierarchical structure of the research set-up in the universities. It is not given to every scientist to steer the right course, take the right decisions and evoke the right responses from co-workers and the support staff. Hence the seemingly democratic approach of making every one take a chance to lead a department can be counter-productive. Experience has also confirmed this. The appointment of a Head of Department must always be made on the basis of aptitude of the scientist to act in this capacity, and once a person has proved to be a success there should be no reason to look for change at short intervals, unless the person concerned himself asks for it.

**8.31** The Study has shown that for nearly 1/4th of the research workers, the time required to complete the work for their degree extends to 6, 7 or 8 years. While the reasons for this undue delay ought to be looked into and some remedial steps should be taken, it should be ensured that the policy with regard to the duration of the award of fellowship is in keeping with the reality. Those who are either late bloomers or whose work has prolonged for reasons beyond their control should not be penalised. The best course of action seems to be that when the first two year period of the Junior Research Fellowship comes to an end, the university should be required to evaluate the performance, and in suitable cases make a definite recommendation for a scholar to be given a Senior Research Fellowship for a period of 3 years. This evaluation should in no case be allowed by the agency sponsoring the fellowship to be made entirely within the university. The agency must nominate at least 2 external members to participate in the full evaluation. A system of this sort will allow any "wasters" to be detected and weeded out, unless there are strong reasons to put them on a simple extension of JRF for one more year. At the end of 5 years when some candidates have still not completed their work, the rules should allow the setting up of another evaluation by which the extensions may be given. The permissiveness involved in this process is necessary because those who have worked with diligence, and done their best, should be given the wherewithal for completing their work, since only after a research worker obtains a Ph.D.

degree, does he or she qualify for being considered for appointment as Research Associate. The evaluations which are suggested to be interposed will provide the incentive to carry on work with all speed, as they will provide checks against lackadaisical performance.

**8.32** Yet another rather unexpected, but authentic finding is that a scholar's having passed the M.Sc. examination in I or II division does not substantially affect the time he or she takes for working for the degree. This certainly means that once a Junior Research Fellowship Examination is insisted on, it serves no purpose to lay down that, in order to be eligible to take the examination, a candidate must have secured a certain percentage of marks at the M.Sc. examination. Hence, it is recommended that all II divisioners and above may appear at the JRF examinations.

**8.33** The Study has highlighted certain aspects of the research process in which suitable intervention could contribute to efficiency and cost-effectiveness of research. Drop out rates are found to be over a large range, between 19% and 55% for various subjects. The data on this has been derived from information about those who registered in Ph.D. and failed to complete it. The rates may actually be somewhat higher than those worked out because of the manner in which institutions supplied the data. It would be of interest to know the period after which a registered scholar dropped-out, and if possible, the reason for dropping out. The common observation of many supervisors is that during the early part of their registration, scholars spend their time basically to prepare for competitive examinations and therefore, many leave the institutions when they get selected in one place or another. It is possible that the better scholars are lost in the process, which comes to an end around two years after the registration. But then many others may be leaving on finding other kinds of employment. There must also be those who leave because they find research to be a tough proposition. It could be very useful to have clarity on these points and some idea of the reasons for dropping out, if any remedial action is to be taken. As they are, and for whatever reason it may be, the high drop out rates represent a major loss both financially and in terms of intellectual effort.

**8.34** Another area which should attract attention stands out if one examines Fig.6.2. It is that a certain percentage of the scholars is able to complete their research work in 2 to 3 years. Which is very remarkable, but then an almost similar percentage of scholars takes what appears to be a far longer period to complete their work, which should be a matter of concern. Case studies have to be made for a large sample of population, at both ends of the time span, and reasons for speedy work in one case and stretching out in the other case must be looked into.



**8.35** It is very important that policy measures are adopted to improve the research environment and processes, and to infuse discipline and a spirit of dedication to work. Incentives with regard to career have also been suggested in this Chapter. The important thing would be to watch the direction, in which the actual situation changes; this can only be done if a similar study, with any reasonable modifications, is conducted once again after next 2 or 3 years, and thereafter every 5 years. In particular, the present Study has not been able to observe any changes in the character of the scholars and their performance, after the introduction of UGC-CSIR Test. This is because the tests were instituted in late 1983, and the scholars who must have registered during 1984, would only now be completing their Ph.D. work. It is because of these considerations that the recommendation is made of repeating the study after a few years.

**8.36** A final suggestion is that, in case the contribution made by this Study in understanding the role of several generally latent factors in research, is appreciated from the point of view that it throws some light on future directions of policy with regard to research in universities, then a comparable study should be made of scientific research being conducted in the laboratories of various agencies. The problems and deficiencies which come to light, would allow suitable steps to be taken to improve the situation. That, it is believed is the specific role of this kind of research.

INVESTIGATION ON SCIENTIFIC RESEARCH IN  
UNIVERSITIES AND I.I.T.s

UNIVERSITY

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DEPARTMENT

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1. Name

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2. Age (in years)

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Sex

male-1, female-2

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3. Designation

lecturer-1, reader or equivalent-2, professor-3

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4. Please give the year and institution of the following:

|                                            | Year                                                           | Institution |   |  |  |       |
|--------------------------------------------|----------------------------------------------------------------|-------------|---|--|--|-------|
| (a) M.Sc./M. Tech                          | <table><tr><td>1</td><td>9</td><td></td><td></td></tr></table> | 1           | 9 |  |  | <hr/> |
| 1                                          | 9                                                              |             |   |  |  |       |
| (b) M. Phil                                | <table><tr><td>1</td><td>9</td><td></td><td></td></tr></table> | 1           | 9 |  |  | <hr/> |
| 1                                          | 9                                                              |             |   |  |  |       |
| (c) Ph. D.                                 | <table><tr><td>1</td><td>9</td><td></td><td></td></tr></table> | 1           | 9 |  |  | <hr/> |
| 1                                          | 9                                                              |             |   |  |  |       |
| (d) Appointment<br>as lecturer             | <table><tr><td>1</td><td>9</td><td></td><td></td></tr></table> | 1           | 9 |  |  | <hr/> |
| 1                                          | 9                                                              |             |   |  |  |       |
| (e) Appointment as<br>reader or equivalent | <table><tr><td>1</td><td>9</td><td></td><td></td></tr></table> | 1           | 9 |  |  | <hr/> |
| 1                                          | 9                                                              |             |   |  |  |       |
| (f) Appointment as<br>professor            | <table><tr><td>1</td><td>9</td><td></td><td></td></tr></table> | 1           | 9 |  |  | <hr/> |
| 1                                          | 9                                                              |             |   |  |  |       |

5. Specialisation \_\_\_\_\_

6. Please mention any national/international awards/distinctions conferred on you: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

7. Number of scholars supervised by you:

(a) so far

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|  |
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(b) at present

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|  |
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8. (a) How many of your research scholars spend more than eight hours per day on research?

none-1, few-2, most of them-3, all-4

|  |
|--|
|  |
|--|



- (b) Approximately how many of your research scholars spend more than 250 days in a year on research?  
none-1, few-2, most of them-3, all-4
9. Do you hold discussion meetings with your research scholar?  
once a week-1, once a fortnight-2, once a month-3  
as and when necessary-4
10. Is it a regular practice in your department to have scholars present their research work at least annually for a discussion at a departmental seminar? Yes/No
11. Do you generally choose problems of research?  
entirely from a curiosity consideration-1  
because of a long range scheme of research in your mind-2  
because of possible applications-3  
because of the Ph.D. degree needs of student served by the available facility-4
12. (a) Do you draw your research support from:  
your own institution-1, research agencies-2, industry/other users-3
- (b) If you draw your research support from industry/user agency, please indicate the following:
- | Name  | Agency | Total grant (approx.) |
|-------|--------|-----------------------|
| <hr/> | <hr/>  | <hr/>                 |
| <hr/> | <hr/>  | <hr/>                 |
| <hr/> | <hr/>  | <hr/>                 |
13. Mention the industries/research agencies from whom you have received assistance at one time or another:  

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14. Is there a systemic link or are you a part of network between your department/institution and: [please put a tick (✓) mark where applicable]
- |                          |                          |                              |
|--------------------------|--------------------------|------------------------------|
| Industry/user agency     | Research agencies        | Other university/institution |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>     |
15. (a) Is any of your research programmes connected with the national thrust areas/national technological missions? Yes/No
- (b) If yes, please specify 

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16. Are you a subscriber of:
- (a) UGC Science Information Service Yes/No
- (b) any other information service, (please specify) 

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17. If you are involved in the research work of other agencies, please indicate the nature of your involvement:
- as a partner in cooperative research programme-1
- as a number of their committee-2
- in planning and development of the agency's programme-3
18. (a) Do you avail the help of specialists from outside for your research work? Yes/No
- (b) If yes, name the specialists and the related agencies:
- (i) \_\_\_\_\_
- (ii) \_\_\_\_\_
- (iii) \_\_\_\_\_
19. Which of the following factors should be improved upon, in your research set up: (please put rank order for first three)
- (a) laboratory facilities
- (b) library facilities
- (c) availability of fund
- (d) university rules for the utilization of funds
- (e) red tape in the funding agency
- (f) lack of connection with institution/agency
- (g) atmosphere of the department/institution
- (h) motivation of scholars
20. In order to get the best results, should supervision be generally:
- more strict-1, more liberal-2, more systematic-3, less structured-4
21. How many of your research scholars have the following characteristics:
- hardly any-1, a few-2, quite a few-3, most-4, all-5
- (a) imaginative and enthusiastic
- (b) sincere and hard working
- (c) weak foundation but willing to learn
- (d) elusive and shirking work
- (e) poor in experimental skills
- (f) poor in ability to write a scientific report or to comprehend literature
- (g) not cut out for research



22. (a) Knowing various difficulties faced by Indian scholars, when you examine and find a thesis to be *unsound* (conceptually, methodologically or analytically) would you:
- reject it outright-1, ask for its revision-2
- request that it be sent to another examiner-3
- give critical evaluation but allow it to be accepted-4
- recommend acceptance in view of hard work put in, or because a Ph.D. programme is partly a training in research-4
- (b) Approximately, how many theses for Ph.D. have you examined so far?
- (c) In your opinion how are they distributed qualitatively?
- hardly any-1, a few-2, quite a number-3, most-4, all-5
- (i) made real intellectual/creative contribution to knowledge
- (ii) made serious critical evaluation of existing knowledge
- (iii) made routine/repetitive study of phenomenon by known methods
- (iv) made study of known variables by new method
23. How many of the top ranking students known to you are now doing research?
- none-1, few-2, some-3, many-4, all-5
24. In many years of your experience with research scholars, how would you generally characterise the following:
- (a) attitude towards research
- extremely casual-1, slightly casual-2, serious-3, highly motivated-4
- (b) working style
- disorganised-1, organised-2, systematic and ever in search of excellence-3
- (c) depth of knowledge
- very shallow-1, confined to the subject-2, interdisciplinary-3
- (d) efficiency
- low-1, medium-2, very productive-3
25. How would you describe the general atmosphere of your laboratory?
- innovative & optimistic-1, creative & positive-2
- dull & unexciting-3, mechanical & discouraging-4
26. How would you rate the role of following factors with respect to scientific research?
- none-1, very little-2, significant-3, very important-4
- (a) reasoning
- (b) reflection

(c) imagination (d) intuition 

27. Which *one* of the following views represents your way of thinking [put a tick (✓) mark]:

(a) Scientists should be concerned exclusively with their own work.

(b) Scientists should be concerned with the application of their work in social and economic development.

(c) Scientists should be concerned with social, economic and political development because their work is related to all these factors.

(d) Scientists should be concerned with all implications of their work and should understand science as an important social and cultural factor.

28. In India, apart from the university/I.I.T.s, a large number of government, industrial and agricultural agencies are conducting pure and applied research. We aspire towards excellence, to undertake research on the very frontiers of knowledge and to apply science in social and economic development. Can you give one or two examples from your field of work, where a highly significant R&D programme is going on, or a very advanced research facility has been or is being established, or a major project has been conceived to bring about social and economic development through science?

|                                               | Example 1            | Example 2            |
|-----------------------------------------------|----------------------|----------------------|
| (i) Brief description                         | <input type="text"/> | <input type="text"/> |
|                                               | <input type="text"/> | <input type="text"/> |
| (ii) Institution/agencies involved            | <input type="text"/> | <input type="text"/> |
|                                               | <input type="text"/> | <input type="text"/> |
| (iii) Name of some of the scientists involved | <input type="text"/> | <input type="text"/> |
|                                               | <input type="text"/> | <input type="text"/> |



INVESTIGATION ON RESEARCH CONDITIONS OF SCHOLARS

DEPARTMENT

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UNIVERSITY

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1. Year of birth 

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 Sex 

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 Accommodation 

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Male-1, Female-2 Hostel-1, Own house-2  
Rented house/Paying guest-3

2. Marital status 

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 Number of children 

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Unmarried-1, Married-2

3. Examination Div./Grade Position Year Institution/University

\*B.Sc./B.E./B.Tech 

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\*M.Sc./M.E./M.Tech 

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M.Phil 

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(\*cross whichever is not applicable)

4. Please indicate the month and year of the following:

|                        |                                              |      |                                                                           |   |   |  |  |
|------------------------|----------------------------------------------|------|---------------------------------------------------------------------------|---|---|--|--|
|                        | Month                                        | Year |                                                                           |   |   |  |  |
| Joining research       | <table border="1"><tr><td></td></tr></table> |      | <table border="1"><tr><td>1</td><td>9</td><td></td><td></td></tr></table> | 1 | 9 |  |  |
|                        |                                              |      |                                                                           |   |   |  |  |
| 1                      | 9                                            |      |                                                                           |   |   |  |  |
| Registration for Ph.D. | <table border="1"><tr><td></td></tr></table> |      | <table border="1"><tr><td>1</td><td>9</td><td></td><td></td></tr></table> | 1 | 9 |  |  |
|                        |                                              |      |                                                                           |   |   |  |  |
| 1                      | 9                                            |      |                                                                           |   |   |  |  |

5. (a) Do you hold a fellowship/scholarship: Yes/No

(b) Name of fellowship/scholarship\_\_\_\_\_

(c) Name of sponsoring agency\_\_\_\_\_

(d) Amount per month Rs. 

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6. (a) Research title as registered in university:\_\_\_\_\_

(b) Please indicate the nature of your research work:

(i) Pure-1, With possible application-2, Applied and sponsored by agency-3, Part of a larger national project-4

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(ii) Theoretical-1, Experimental or field oriented-2, Needs a computer-3

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## 7. Level of parents' education:

Illiterate-1 Middle pass-2

High school-3 Intermediate-4

Graduate-5 Postgraduate-6

Professional (law, doctor, engineer, etc.)-7

(a) Mother

(b) Father

## 8. Place where your parents normally live:

Village-1, Town-2, Small city-3, Big city-4, Metropolis-5

## 9. Guardian's profession:

Farmer-1, Skilled/Technical worker-2, Trader/Shopkeeper-3

Clerical/Office work-4, Teaching/Research-5

Officer in govt./private office-6, Businessman/Lawyer/Doctor-7

MLA/MLC/MP etc.-8, Industrialist-8

## 10. Number of research scholars under your supervisor:

## 11. Number of papers published by you in refereed journals in:

| Ist | 2nd | 3rd | 4th | 5th | 6th | 7th |
|-----|-----|-----|-----|-----|-----|-----|
|     |     |     |     |     |     |     |

year of work

(Please attach a list of your publications)

## 12. Have you been seriously interested/engaged in any of the following activities: [You can tick (✓) mark upto three]

painting/sketching

music/dance

floral art

embroidary

handicrafts

composing poetry

translating

journalism

study of plants

bird watching

star gazing

writing plays/stories/science fiction

making and repairing mechanical/electrical gadgets

any other

## 13. Please rate the quality of the following in your department:

very poor-1, poor-2, fair-3, good-4, excellent-5

(a) library facilities



|                                                                                                                                                                          |                      |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|
| (b) documentation                                                                                                                                                        | <input type="text"/> |
| (c) equipment                                                                                                                                                            | <input type="text"/> |
| (d) maintenance                                                                                                                                                          | <input type="text"/> |
| (e) purchase of consumable or other items                                                                                                                                | <input type="text"/> |
| (f) management and co-ordination of facilities                                                                                                                           | <input type="text"/> |
| (g) laboratory assistance service                                                                                                                                        | <input type="text"/> |
| (h) research guidance                                                                                                                                                    | <input type="text"/> |
| (i) general team work and co-operation                                                                                                                                   | <input type="text"/> |
| (j) computer facility                                                                                                                                                    | <input type="text"/> |
| 14. The running of your research unit/department is:                                                                                                                     | <input type="text"/> |
| (i) autocratic-1, democratic-2, fair minded-3                                                                                                                            | <input type="text"/> |
| (ii) encouraging-1, frustrating-2, Callous-3                                                                                                                             | <input type="text"/> |
| 15. (a) Do you find the rules and regulations regarding for purchase of equipment, sanction of funds for attending seminars/conferences or inviting experts/consultants: | <input type="text"/> |
| simple-1, bureaucratic-2, time consuming-3, almost impossible to get through-4                                                                                           |                      |
| (b) In connection with your research work, if any expenditure is to be incurred or any out of the way thing is to be done, who is the sanctioning authority:             | <input type="text"/> |
| your supervisor-1, head of the department-2, dean-3<br>finance officer-4, registrar-5, vice-chancellor-6                                                                 |                      |
| 16. In your opinion how often a research scholar in your department would get recognition and encouragement in accordance with merit irrespective of:                    |                      |
| never-1, occasional-2, frequent-3, always-4                                                                                                                              |                      |
| (a) sex                                                                                                                                                                  | <input type="text"/> |
| (b) caste                                                                                                                                                                | <input type="text"/> |
| (c) religion                                                                                                                                                             | <input type="text"/> |
| (d) domicile                                                                                                                                                             | <input type="text"/> |
| (e) non-academic efforts                                                                                                                                                 | <input type="text"/> |

17. Is it regular practice in your department to have scholars present their research work at least annually for a discussion at a departmental seminar? Yes/No
18. (a) Are the major facilities of the laboratories of your department available to *all* the scholars? Yes/No
- (b) Are the major facilities in *other* department/institution easily available to all the scholars? Yes/No
- (c) In the course of your research have you used facilities:
- (i) in other laboratories of your department Yes/No  
name the facility\_\_\_\_\_
- (ii) in other departments Yes/No  
name the facility\_\_\_\_\_
- (iii) in other university/institution Yes/No  
name the facility\_\_\_\_\_
19. (a) Are you using library/documentation service in:
- (i) other departments Yes/No
- (ii) other university/institution Yes/No
- (b) Are you aware of the UGC Science Information Service: Yes/No
20. (a) During the course of your research work have you sought guidance from any experts in your field, who are outside your university/institution: Yes/No
- (b) If yes, please provide the name/s\_\_\_\_\_
- \_\_\_\_\_
21. (a) Are you in contact with other research workers who are working on a problem similar/related to your field? Yes/No
- (b) If yes, please name the scholar/organisation\_\_\_\_\_
- \_\_\_\_\_
22. (a) List the state/national seminars along with the years, you have *attended* during your research career

Seminar

Year

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

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(b) Have you won any awards/recognition for your research work?  
Yes/No

(c) If yes, please give the name and year \_\_\_\_\_  
\_\_\_\_\_

23. How was your research topic decided:

- supervisor proposed on the basis of discussion with industry/other users-1
- supervisor proposed on the basis of previously published work-2
- you proposed on the basis of your own reading-3
- you proposed on the basis of a bright idea that struck you while doing certain other experiments-4
- related work was already being done in the laboratory-5
- project was already sanctioned on that topic-6

☐

24. Which of the following phrases characterises your supervisor:

- (a) upto date in knowledge
- (b) well connected with other specialists/institution
- (c) associated with industry/agriculture
- (d) devotes enough time for research scholars
- (e) actually participates in research activity of scholars
- (f) checks the data/experimental readings
- (g) gives generous credit to the original ideas put by the scholars
- (h) skilful in dealing with people
- (i) men of ideas

☐☐☐☐☐☐☐☐☐

25. When your work is published as a paper in a journal, the co-authors include:

- other scholar/s who worked on the problem-1, supervisor-2
- head of unit-3, head of the department-4

☐

26. In case you come across some observation while engaged in research which does not fit with existing theories or results obtained by others would you:

- Reject the observation-1, redesign the experiment to verify observation-2
- review the theory-3, believe in your observation and proceed further-4

☐

27. Who do you think basically suggests the names of the examiners of theses in your department:

- supervisor-1, head of the department-2, dean-3, vice-chancellor-4
- research committee-5

☐

28. How frequent are the following practices in your department?  
never-1, occasional-2, frequent-3

(a) manipulation of data

(b) forging of data

(c) using unacknowledged data from somebody else's work

(d) appointing specially considerate examiners

(e) awarding degrees in spite of very critical reports  
of examiners

(f) making exaggerated/false/premature claims in  
non-scientific forums and publications

29. Given a choice, which *one* of the following jobs would you prefer:  
research-1, teaching-2, administrative-3  
a post which requires a lot of foreign travel-4

30. What is the level of dedication to research, amongst your fellow research,  
amongst your fellow research workers:  
very high-1, high-2, medium-3, low-4, very low-5

31. Comparing yourself with other persons of your age and qualification, how  
successful do you consider yourself to be:  
very successful-1, fairly successful-2, unsuccessful-3

32. How many of the *top* students who studied with you, are now doing  
research?  
none-1, few-2, some-3, many-4, all-5

33. How would you describe the general atmosphere of your laboratory?  
Innovative and optimistic-1, creative and positive-2  
dull and unexciting-3, mechanical and discouraging-4

34. How would you rate the role of the following factors with respect to  
scientific research?  
none-1, very little-2, significant-3, very important-4

(a) reasoning

(b) reflection

(c) imagination

(d) intuition

35. Which *one* of following views represent your ways of  
thinking:

(a) scientists should be concerned exclusively with their  
own work.



- (b) scientists should be concerned with the application of their work in social and economic development.
- (c) scientists should be concerned with social, economic and political development because their work is related to all these factors.
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36. In India, apart from the Universities/I.I.T.s, a large number of government, industrial and agricultural agencies are conducting pure and applied research. We aspire towards excellence, to undertake research on the very frontiers of knowledge and to apply science in social and economic development. Can you give one or two examples from your field of work, where a highly significant R&D programme is going on, or a very advanced research facility has been or is being established or a major project has been conceived to bring about social or economic development through science:

|                                               | Example 1   | Example 2   |
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| (i) Brief description                         | <div></div> | <div></div> |
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| (iii) Name of some of the scientists involved | <div></div> | <div></div> |



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(Not to be filled)

## DATASHEET

NAME \_\_\_\_\_

DEPARTMENT \_\_\_\_\_

1. M.Phil/Ph. D.

(a) Division \_\_\_\_\_ Percentage \_\_\_\_\_ Year 19 \_\_\_\_\_

(b) University from which passed qualifying examination  
\_\_\_\_\_

2. Please indicate the month &amp; year of the following :

|                         | MONTH | YEAR  |
|-------------------------|-------|-------|
| Registration            | _____ | _____ |
| Submission of thesis    | _____ | _____ |
| Report of last examiner | _____ | _____ |
| Viva-voce               | _____ | _____ |
| Declaration of result   | _____ | _____ |
| Award of degree         | _____ | _____ |

3. (i) Name/s of the supervisor:

(a) \_\_\_\_\_ (b) \_\_\_\_\_

(ii) In case of change of supervisor give the name:  
\_\_\_\_\_4. Topic of the research \_\_\_\_\_  
\_\_\_\_\_

5. Names of thesis examiners :

(i) \_\_\_\_\_

(ii) \_\_\_\_\_

(iii) \_\_\_\_\_

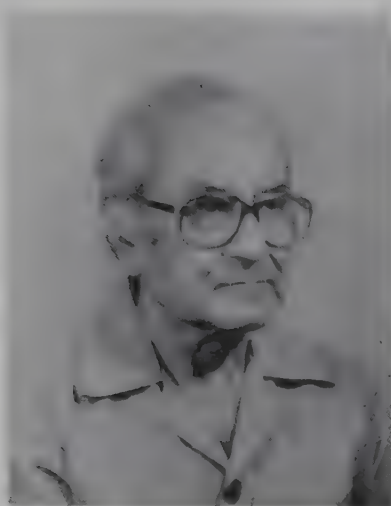
6. Whether student was receiving fellowship/scholarship:  
If yes, please give the following:

Yes/No

| Name of fellowship | Sponsoring agency | Month & year of award | Duration |
|--------------------|-------------------|-----------------------|----------|
| (i) _____          | _____             | _____                 | _____    |
| (ii) _____         | _____             | _____                 | _____    |







**Professor Rais Ahmed** is a physicist who is known for his innovations in education, and for policy initiatives with regard to improvement of scientific research in the universities and its utilization for national development. He has been Director of the National Council for Educational Research and Training, Vice-Chancellor of Kashmir University, Vice-Chairman of the University Grants Commission and a member of the Science Advisory Committee of the Cabinet. At present he is Executive Director of the Tertiary Education Commission in Mauritius. He was awarded Padma Bhushan in 1984.



**Ms. Madhulika Rakesh** is an experienced researcher in the field of investigating conditions, processes and value systems of scientific research, first at Lucknow University, then at the University Grants Commission and finally with the Council of Scientific & Industrial Research on the Project which is reported in this book.













